Municipal News and Water Works

Vol. LXXVI JUNE, 1929 No. 6

The 1929 Convention of American Water Works Association

49th Annual Meeting Meets June 24-28 at Toronto, Ont.

THE 49th annual convention of the American Water Works Association, which is to be held June 24-28 inclusive at Toronto, Ont., will be one of the most important meetings ever held by this association. Action will be taken at the convention on the adoption of a new constitution for the association.

The New Constitution. — The new constitution, the result of a year's deliberation by a committee appointed at the 1928 convention. Its main feature is the formation of a board of directors, which will have full control of all activities of the association. The board will appoint all committees and provide for the general administration of the affairs and property of the association.

The board of directors will consist of the president of the association, the treasurer of the association, the latest living past president of the association, the chairman of the committee on water works practice, the chairman of the publication committee, one director elected by the members of the Water Works Manufacturers Association, and one director elected by each section of the association. This later representation means that every part of the territory covered by the association will have its representative and will have a part in formulating and executing the policies of the association.

Royal York Hotel, Where 49th Annual Convention of American Water Works Association Will Be Held

The board of directors will meet each year at the annual convention and it is also proposed to have a meeting in January of each year at which all the directors will be present. In order to give continuity to the board membership the term of the directors representing the sections will be so arranged that approximately one-third of them will retire each year.

The new constitution also provides for an executive committee consisting of the president and four directors, which will direct the administrative work of the association and carry out the policies of the board between meetings of the latter. This committee will be chosen by the board at its meeting at the annual convention.

Provision also is made in the new constitution for additional conventions or regional meetings, but such meetings are only to be held as found advisable. In general, they would be held when and as desired by the sections in any portion of the territory covered by the association.

The Convention.—The headquarters of the convention will be at the new Royal York Hotel, which was officially opened on June 11. The entertainment which will be given at this convention includes a reception and dance the opening night, theatre and card parties, bus rides, tea at the Yacht Club and a shopping tour for the ladies; smoker for the men and a dinner dance for everyone on Thursday evening.

The delegates will be given an opportunity of inspecting the water works system of the city of Toronto and trips to the different stations and filter plant will be arranged upon registration.

Exhibits.—Nearly 100 manufacturers of water works supplies will show their products in the large hall on the convention floor of the Royal York Hotel, and already this large room, 62 ft. by 164 ft., is unable to accommodate everyone who desires to be represented at this meeting.

The following is a list of the exhibitors who have been assigned space.

Pittsburgh Equitable Meter Company
The American City
Paradon Mfg. Company
U. S. Cast Iron Pipe and Foundry Co.
Buffalo Meter Company
National Tube Company
Public Works (Journal).
Neptune Meter Company
Thomson-Adriance, Inc.
Eddy Valve Company
National Water Main Cleaning Co.
The A. P. Smith Mfg. Company
Water Works Engineering
R. D. Wood & Company
The American Brass Company
Union Water Meter Company
Canadian Engineer
The Kennedy Valve Mfg. Co.
Gillette Publishing Company
McWane Cast Iron Pipe Company
The Dorr Company
Engineering News-Record
Mueller Company
Hays Manufacturing Company
W. J. Savage Company
Lock Joint Pipe Company
Michigan Valve and Foundry Co.
Chicago Bridge and Iron Works
National Meter Company
Builders Iron Foundry
Columbian Iron Works
Pittsburgh-Des Moines Steel Co.
Rensselaer Valve Company
Worthington Pump and Machinery Corp.
International Filter Company
Layne & Bowler, Inc.
Wailes Dove—Hermiston Corp.
Bingham & Taylor Corp.
Lead Lined Pipe Company
The James Morrison Brass Mfg. Co.
R. W. Sparling
The Pitometer Company
David B. McWilliams
Ross Valve Mfg. Co., Inc.
Fittings Limited
Canadian Brass Company, Ltd.
Ford Meter Box Company
Fairbanks, Morse & Company
The Leadite Company
Red Hed Mfg. Company
Francis Hankin & Co., Ltd.
Hersey Mfg. Company
Hydraulic Development Company
Empire Brass Mfg. Co., Ltd.
Simplex Valve & Meter Co.
Gamon Meter Company
Badger Meter Mfg. Company
Canada Iron Foundries, Ltd.
Iowa Valve Company
Automatic Cone Valve Company
Phoenix Meter Company
Wallace & Tiernan Co., Inc.
Barber-Greene Company
National Aluminate Corp.
The Central Foundry Company
East Jersey Pipe Company
Jenkins Bros. Limited
Gartshore Thompson Pipe & Foundry Co., Ltd.
Canadian Westinghouse Company, Ltd.
The American Rolling Mill Company
American Cast Iron Pipe Company
De Laval Steam Turbine Company
James B. Clow & Sons
National Iron Corporation, Ltd.
Jordan, Roberts Sales, Ltd.
The Canada Valve & Hydrant Co., Ltd.
Page-Hersey Tubes, Ltd.
T. McAvity & Sons, Ltd.
Canadian Industries, Ltd.
The Atlas Mineral Products Co.
Canada Metals Co., Ltd.
Chase Companies, Inc.

The program of the 49th annual convention follows:

MONDAY, JUNE 24, 1929

Forenoon

8:00 Registration.

9:00 Committee on Water Works Practice.

Malcolm Pirnie, Chairman. Hazen, Everett & Pirnie, Consulting Engineers, 25 W. 43rd St., New York, N. Y.

11:00 Executive Committee.

Afternoon Sessions

Plant Management and Operation Division and Superintendents' Round Table Discussion.

H. F. Huy, Chairman, General Manager, Western New York Water Company, 11 Niagara St., Buffalo, N. Y.

2:00 Ball Room.

The following members will lead the discussions:

J. W. Ackerman, Watertown, N. Y.
W. W. Brush, New York, N. Y.
C. K. Calvert, Indianapolis, Ind.
W. S. Cramer, Lexington, Ky.
F. C. Dugan, Louisville, Ky.
J. E. Gibson, Charleston, S. C.
D. E. Kepner, Denver, Colo.
M'Kean Maffitt, Wilmington, N. C.
W. S. Patton, Ashland, Ky.
A. U. Sanderson, Toronto, Ont., Can.
J. F. Skinner, Rochester, N. Y.
L. A. Smith, Madison, Wis.

2:00 West Hall.

Committee No. 1—Standard Methods of Water Analysis.

J. J. Hinman, Jr., Chairman, Associate Professor of Sanitation, University of Iowa, Iowa City, Ia. Everybody welcome.

Evening

9:00 Informal Reception and Dance. Concert Hall.

Address of Welcome—Mayor Samuel McBride of Toronto.

TUESDAY, JUNE 25, 1929

Forenoon Sessions

9:00 Ball Room.

Opening of Convention.

William W. Brush, President.

Announcement of Officers and Trustees elected for the year 1929-30.

Reports of Secretary, Treasurer and Executive Committee.

Action on Budget.

Report of Committee on Water Works Practice.

New Business.

Conference of Committee No. 19, Boiler Feed Water Studies.

Sheppard T. Powell, Chairman, Chemical Engineer, 213 St. Paul Pl., Baltimore, Md.

9:00 West Hall.

Recent Developments in Boiler Operation and Their Influence on Feedwater Treatment.

Sheppard T. Powell, Chemical Engineer, 213 St. Paul Pl., Baltimore, Md.

Deaeration of Boiler Feedwater.

J. R. McDermet, Research Engineer, Elliott Company, Jeannette, Pa.

The Dissociation of Water in Steel Tubes at High Temperatures and Pressures.

Illustrated by Lantern Slides.

C. H. Fellows, Detroit Edison Company, Detroit, Mich.

Calculation of Chemicals for Water Softening.

A. M. Buswell, Chief, State Water Survey, Urbana, Ill.

TUESDAY, JUNE 25, 1929

Afternoon Sessions

2:00 Ball Room.

Symposium on Pumping Station Practice:

Selection of Pumping Station Equipment.

Illustrated by Lantern Slides.

A. P. Pigman, American Water Works & Electric Company, New York, N. Y.

Equipment for Electrically Driven Pumping Stations.

R. L. Baldwin, Burns & McDonnell, Consulting Engineers, Kansas City, Mo.

Pump Discharge Headers and Pump Piping for Waterworks Stations.

Illustrated by Lantern Slides.

F. G. Cunningham, Fuller & McClintock, Consulting Engineers, 170 Broadway, New York, N. Y.

Discussion by L. A. Day, Water Commissioner, St. Louis, Mo.

Selection of Equipment for Clove Pumping Station of Staten Island System.

William Flannery, Mechanical Engineer, Department of Water Supply, Gas & Electricity, New York, N. Y.

Comparative Data on Steam and Electrical Pumping Stations.

Illustrated by Lantern Slides.

John F. Laboon, J. N. Chester Engineers, Pittsburgh, Pa.

Conference of Committee No. 19, Boiler Feed Water Studies.

2:00 West Hall.

The Prevention of Pitting in Locomotive Boilers by Exclusion of Dissolved Oxygen from the Feedwater.

C. H. Koyl, Engineer of Water Service, Chicago, Milwaukee, St. Paul & Pacific Railroad Company, Chicago, Ill.

Discussion by R. E. Coughlan, Supervisor of Water Supply, Chicago & Northwestern Ry. Co., Chicago, Ill., and F. N. Speller, National Tube Co., Pittsburgh, Pa.

Railway Water Treatment Progress and Research Requirements.

R. C. Bardwell, Superintendent Water Supply, Chesapeake & Ohio Railway Company, Richmond, Va.

Hydrogen Ion and Conductivity Measurement.

Illustrated by Lantern Slides.

C. Z. Rosecrans, Chief of Chemical Division, Leeds & Northrup Company, 4901 Stenton Ave., Philadelphia, Pa.

2:00 For the Ladies—

Bus tour of city and tea at Royal Canadian Yacht Club—see page 12.

Evening

6:45 Dinner, Water Purification division.

8:00 Ladies' Card Party.

WEDNESDAY, JUNE 26, 1929

9:00 Ball Room.

Business Meeting Canadian Section.

10:00 Ball Room.

General Session—(This session will open one hour later than ordinarily to provide for the business meeting of the Canadian Section and obviate decreased attendance which would otherwise occur if the two meetings were held concurrently.)

Ethics for Engineering Services.

Nicholas S. Hill, Jr., Consulting Engineer, 112 East 19th St., New York, N. Y.

Durability of Distribution Systems.
Illustrated by Lantern Slides.
H. Y. Carson, National Cast Iron Pipe Company, Birmingham, Ala.

Operating Experiences with Large Capacity Filter Plants.
J. Clark Keith, Chief Engineer, Essex Border Utilities Commission, Windsor, Ont., Can.

Water Purification Division.
W. F. Langelier, Chairman, Associate Professor of Sanitary Engineering, University of California, Berkeley, Calif.

9:00 West Hall.

Values in Natural and Artificial Purification with Reference to the Sangamon River at Springfield, Ill.
Illustrated by Lantern Slides.
Charles H. Spaulding, Superintendent of Purification, Springfield, Ill.

The Deposition of Manganese Dioxide in the Aqueduct of the Catskill Water Supply.
Frank E. Hale, Director of Laboratories, Department of Water Supply, Gas and Electricity, New York, N. Y.

Micro-organisms in the Lake Michigan Water and Their Effect on Filtration.
Illustrated by Lantern Slides.
John R. Baylis and H. H. Gerstein, Bureau of Engineering, Chicago, Ill.

Innovations in the Treatment of Water in the Province of Ontario.
A. V. DeLaporte, Chemist, Department of Health of Ontario, Toronto, Ont., Can.

Some Unusual Features in Design of the New Water Purification Plant at Niagara Falls.
F. A. Dallyn, Civil Engineer, 71 Knight St., W., Toronto, Ont., Can.

WEDNESDAY, JUNE 26, 1929

Afternoon Session

2:00 Ball Room.

Field Practice in Chlorination of New and Old Water Mains.
Joseph S. Strohmeyer, Asst. Civil Engr., Water Department, Baltimore, Md.

The Chlorine Institute Standard Valve for Chlorine Containers.
Illustrated by Lantern Slides.
R. T. Baldwin, Secretary, The Chlorine Institute, New York, N. Y.

Cobble Mountain Dam of the Springfield, Mass., Water Works.
Illustrated by Lantern Slides.
Allen Hazen, Hazen, Everett & Pirnie, Consulting Engineers, 25 West 43rd St., New York, N. Y.

Water-Borne Epidemics on Ships with Reference to the Outbreak on the Lake Gaither.
I. W. Mendelsohn, U. S. Public Health Service, 45 Broadway, New York, N. Y.
Discussion by J. I. Connolly, Chief, Bureau of Sanitary Engineering, Chicago Department of Health, Chicago, Ill.; George H. Ferguson, Chief Engineer, Department of Pensions and National Health, Ottawa, Ont., Can., and Arthur E. Gorman, Wallace & Tiernan Co., Inc., Newark, N. J.

2:45 For the Ladies—
Shopping tour and tea.

Evening Session

8:00 Ball Room.

General Session—Preceding Smoker.
The Toronto Water Works System.
R. C. Harris, Commissioner of Works, Toronto, Ont., Can.

The New Filtration Plant and Other Extensions of the Toronto Water Works.
Illustrated by Lantern Slides.
William Gore, Consulting Engineer, Toronto, Ont., Can.

8:00 Ladies' Theatre Party.

9:30 Smoker. Concert Hall.

THURSDAY, JUNE 27, 1929

Forenoon Sessions

Plant Management and Operation Division.
H. F. Huy, Chairman, General, Western New York Water Company, 11 Niagara St., Buffalo, N. Y.

9:00 Ball Room.

Business Meeting of Division.

Pure Stream Movement Will Accomplish Its Purpose.
Scotland G. Highland, General Manager, Clarksburg Water Board, Clarksburg, W. Va.

Cement for Cast Iron Pipe Joints.
O. G. Goldman, Assistant Superintendent of City Distributing System, Spring Valley Water Company, San Francisco, Calif.

Management and Operation of a Canadian Water Works System.
W. E. MacDonald, City Water Works Engineer, Ottawa, Ont., Can. Discussion—J. Walter Ackerman, City Manager, Watertown, N. Y.; R. L. Dobbin, Superintendent Water Works, Peterborough, Ont., Can.; G. G. Routledge, Superintendent Water Distribution, Toronto, Ont., Can.

The Two-Main System of Water Distribution.
Illustrated by Lantern Slides.
J. B. Eddy, Engineer, Water Pipe Extensions, 404 City Hall, Chicago, Ill.

Water Purification Division.

9:00 West Hall.

The Relation of Direct B. Coli and B. Aerogenes Counts, Obtained on Cyanide-Citrate Agar, to Sources of Pollution.
Illustrated by Lantern Slides.
Fred O. Tonney and R. E. Noble, Bureau of Laboratories and Research, Department of Health, Chicago, Ill.

Lactose Fermenting Bacilli Growing on Leather Washers.
Frank E. Greer and Laura C. Kells, Bureau of Laboratories and Research, Department of Health, Chicago, Ill.

Ultra-Microscopic Studies of Colloids in Water.
C. H. Christman, National Aluminate Corporation, Chicago, Ill.

The Use of Activated Carbon in Removing Taste Producing Substances from Water.
Illustrated by Lantern Slides.
John R. Baylis, Physical Chemist, Bureau of Engineering, Chicago, Ill.

THURSDAY, JUNE 27, 1929

Afternoon Sessions

2:00 Ball Room.

General Session.
G. G. Dixon, Chairman, Deputy Chief Engineer, Mahoning Valley Sanitary District, Youngstown, O.

Symposium on Large Size Pipe Lines: Welded Steel Pipe at Springfield, Mass.
Illustrated by Lantern Slides.
Allen Hazen, Hazen, Everett & Pirnie, Consulting Engineers, 25 West 43rd St., New York, N. Y.

Electrically Welded Steel Pipe Lines.
Illustrated by Lantern Slides.
Samuel Martin, Jr., Industrial Engineer, General Electric Co., Schenectady, N. Y.

Discussion—William Flannery, Mechanical Engineer, Department of Water Supply, Gas and Electricity, New York; J. F. Lincoln, President, Lincoln Electric Co., Cleveland; E. E. Shanor, Petroleum Iron Works Co., Sharon; F. H. Stephenson, Engineer of Water System, Detroit.

Notes on European Pipe Practice.
R. H. Keays, Chief Engineer, Ulen & Company, Athens, Greece.

Standard Practice in Steel Plate Pipe Lines.
Discussion—Wm. W. Brush, F. G. Cunningham, John F. Laboon, A. V. Ruggles, F. H. Stephenson, T. H. Wiggin, F. E. Winsor, C. V. Witt.

Water Purification Division.

2:00 West Hall.

Trends in Municipal Zeolite Water Softening.
Illustrated by Lantern Slides.
W. J. Hughes, Mechanical Engineer, and H. B. Crane, Principal Assistant Engineer, International Filter Company, Chicago, Ill.

Reduction of Carbonate Hardness by Lime Softening to Theoretical Limit.
Charles P. Hoover, Chemist in Charge, Water Softening and Purification Works, Columbus, O., and James Montgomery, Superintendent of Water Works, Piqua, O.

Zeolite Softening Plant Operating Experiences.
Illustrated by Lantern Slides.
D. E. Davis and J. T. Campbell, J. N. Chester Engineers, Pittsburgh, Pa.

Operating Experiences with a New Water Softening Plant at Marion, O.
Illustrated by Lantern Slides.
Martin E. Flentje, Superintendent of Filtration, Community Water Service Company, 46 Cedar Street, New York, N. Y., and Charles Whysall, Chemist in Charge, Marion Water Softening Plant, Marion, O.

Evening

7:30 Dinner Dance—Informal. Concert Hall.

FRIDAY, JUNE 28, 1929

Forenoon Session

9:00 Ball Room.

New Developments in the Safeguarding of Cross Connections in New York State.

Illustrated by Lantern Slides.

C. A. Holmquist, Director, and Earle Devendorf, Associate Director, Division of Sanitation, State Department of Health, Albany, N. Y.

Mechanical Developments in Water Treatment Practice.

Illustrated by Lantern Slides and Motion Pictures.

C. T. Leander, The Dorr Company, Toronto, Ont., Can.

Steel Tanks for Water Works Systems.

Geo. T. Horton, President, Chicago Bridge & Iron Works, Chicago, Ill.

Methods of Water Softening and Filtration.

J. A. McGarigle, Permutit Company of Canada, Ltd., Toronto, Ont., Can.

Afternoon Sessions

2:00 Ball Room.

Joint Session Plant Management and Operation Division, and Superintendents' Round Table Discussion.

Effect of Rigid Jointing Material on the Strenth of Pipe Bells.

W. W. Brush, Chief Engineer, Department of Water Supply, Gas and Electricity, New York, N. Y.

Cement Lining Small Iron Pipe—A Method Suitable for Small Utilities.

Illustrated by Lantern Slides.

R. W. Reynolds, Superintendent, West Palm Beach Water Company, West Palm Beach, Fla.

2:00 Committee on Water Works Practice.

New Well Construction in Prescott

Perforated Corrugated Pipe Infiltration Gallery

By ARTHUR J. KLINE
City Engineer, Prescott, Ariz.

PRESCOTT, ARIZ., a mountain town of 8,000 population has probably as much trouble developing water as any town outside the desert. Fifty-four hundred feet in elevation, surrounded on three sides by mountains and on the fourth by a receding valley it is aptly called the Jewel of the Mountains. All the water passing this town must fall within six miles, and all is carried by Granite Creek running through town and down the valley.

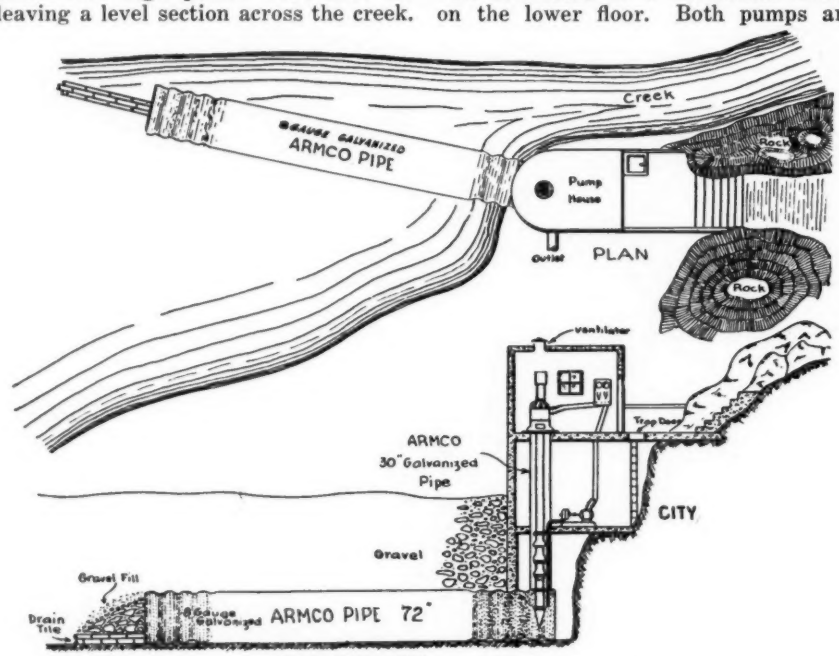
A storage dam in the hills south of town impounds seven months storage and furnishes ample water during the years of normal rainfall, but when no snow nor rain falls for one year this reservoir is empty. Over a period of years by experimenting with cutoff walls, diversion dams, tunnels, side infiltration galleries and wells the water department has tried to use the under ground water of Granite Creek as an emergency supply. In 1928 a successful well was developed. At a narrow point across Granite Creek the gravel was stripped to bedrock with a drag line. The high points were shot off leaving a level section across the creek.

A 50-ft. section of 72-in. special collection pipe made of No. 8 gauge galvanized corrugated Armco ingot iron fitted with a 30-in. No. 10 gauge galvanized corrugated Armco ingot iron riser was installed. The collection pipe was perforated with ½-in. holes all around in the valley of every corrugation on five-inch centers. This equals 8 sq. ft. of opening. The ends were bulkheaded and from one was run three 6-in. drain tile laterals. The backfill over both tile and collecting pipe was made of 2 ft. of graded rock, then ordinary sand and gravel up to the level of the creek.

The Armco collection pipe was chosen instead of a cutoff wall for the accessibility of the tunnel. During low water when the pump holds the well low a man can decend a ladder in the pump house and walk back through the tunnel to clean out any sand or silt. The pipe has a long life and will apparently last indefinitely. When not pumping the water flows through the well and always shows fresh and clear. During the recent dry period the pump ran 2 hours and was off one hour. A flood 4 ft. deep came down the creek running muddy water from bank to bank. A man sent down to investigate reported that the pump was still running clear water and still shutting off one hour out of three, showing that the water filtered to bedrock some distance from the pump house.

After the first month of pumping the well was cleaned and since then no sand has come through the gravel bed.

A vertical 100 h.p. motor connected to the 600 g.p.m. turbine pump is on the upper floor. A multiple centrifugal pump of 300 g.p.m. capacity is direct connected to a horizontal motor on the lower floor. Both pumps are operated from the same automatic starter and float switch.



Plan and Section of New Well at Prescott, Ariz.

The whole layout has been very successful and considering the low cost of installation and lack of maintenance the work stands as good 1928 construction methods.

Street Traffic Survey for Kansas City, Mo.—A street traffic survey for Kansas City, Mo., was started on May 15 under the direction of Dr. Miller McClintock. It is expected the survey will be completed in a year. The estimated cost is $25,000. The survey, which will be city-wide in scope, is being made for the purpose of developing a comprehensive plan for relief from traffic congestion and traffic accidents.

Detroit Voters Defeat Subway Plan.—At a recent election the voters of Detroit rejected the proposal for a subway. The Rapid Transit Commission had recommended that 17 per cent of the total tax be raised by an ad valorem tax on the city at large; 51 per cent on benefited property adjacent to the subway, and 32 per cent to pay for train tracks and other equipment, through a ten-cent subway fare.

Methods of Financing Municipal Improvements

Different Types of Municipal Obligations Classified and Discussed

By HOLLAND M. CASSIDY
Of the Chicago Bar

WHENEVER a municipal improvement is to be constructed it usually involves the borrowing of money because the growing needs of municipalities have consumed revenues as rapidly as, and in many instances more rapidly than funds could be provided. Statutes authorizing the levy of taxes do not contemplate the accumulation of large surpluses which may be used for an improvement to be constructed at some future time. A thrifty community may be found that has carefully protected its treasury, and surpluses exist either by reason of savings in ordinary corporate expenses or profits from the operation of a water works or some other utility, but this is not the usual case. At times legislatures have authorized the levy of a special tax for a specified period for the purpose of constructing some particular improvement such as a courthouse or roads. This method of financing is not satisfactory because the funds come in over a period of years and it is not practical or economical to so extend construction work.

The federal government contributes a portion of the cost of some improvements, particularly road work and levee work, and when such contributions are made the government insists upon either supervision or actual construction of the improvement. In those instances the municipality is sometimes required to turn its money over to the government for expenditures. Experience has demonstrated that the tax payers get their full dollar of value where this procedure is followed.

It is impossible in an article of this type to go into any detail as to the particular procedure for municipal financing since that is governed by the statutory laws of various states, and any consideration of that subject would require a complete detailing of the statutory procedure prescribed by the several states.

In any consideration of municipal financing it is well to have clearly in mind the different types of municipal obligations. A classification of these bonds must group itself on the basis of taxes or revenues to pay the same, from the viewpoint of both the issuing municipality and the purchaser. The following classification and suggestions are submitted:

Unlimited Ad Valorem Tax Bonds.—Principal and interest of these bonds are payable from unlimited ad valorem taxes levied by constitutional mandate at the time the bonds are issued, or for the levy of which mandatory provisions exist, so that all that remains to be done is to extend and collect the tax. This is the best type of municipal bond and the only worry in connection with these bonds is as to the integrity of the community and the probability of its continuance with ample values to support the taxes.

Limited Ad Valorem Tax Bonds.—These bonds are exactly the same as the limited ad valorem tax bonds except that by constitutional or statutory enactment the amount which may be levied in any year to pay principal and interest is limited. In determining the value of these bonds special consideration must be given to the probable amount of taxes which may be realized over the lifetime of the issue from the limited levy, and also as to whether the statute permits the issuance of additional obligations against such tax which will share ratably in the proceeds thereof.

General Obligation Improvement Bonds.—The primary tax to pay these bonds consists of special assessments levied upon benefited property and the obligation requires the municipality to levy ad valorem taxes sufficient to make up deficiencies. This makes a very desirable bond provided the aggregate amount thereof is not disproportionate to the assessed value of taxable property of the municipality; for instance, if the assessed value of the municipality is $2,000,000 and the amount of such bonds outstanding is $2,000,000, patently the bonds are little better than a straight special assessment bond.

Revenue Bonds.—These obligations are payable from excise levies such as water rents, instead of ad valorem taxes, and are usually issued for the purpose of constructing water works or other utilities. Recently an endeavor has been made to add to this type of bond obligations payable from gas taxes and the like. The test applicable to these bonds is the certainty and sufficiency of revenues, together with statutory requirements tending to produce integrity in the application of the revenues and assurance that sinking fund requirements come before operating charges.

Benefit Tax Bonds.—These bonds are payable from taxes to be extended from year to year against benefited property, the aggregate amount of which benefits is fixed. This type of bond is usually issued by irrigation districts and some of the western drainage districts.

Special Assessment Bonds.—These are bonds payable from special assessments levied in a specified amount upon particular properties benefited from local improvement work. These bonds constitute desirable securities if the property values are sufficient to support the special assessment liens and the amount of assessments available to pay the bonds is ample to retire the issue.

Tax Bills.—These obligations are issued by the municipality against particular pieces of property on account of benefits derived from the construction of a local improvement. They are in odd amounts and are a lien only upon particular pieces of property. Of course the value of each depends upon the value of the property against which it is issued. The great objection to this type of security is its marketability. The most successful mode of handling this type of paper has been to deposit the tax bills with a trust company and issue debentures or participating certificates against the proceeds of the aggregate deposit.

Bonds Payable from Taxes to Be Levied.—This type of bond is rapidly disappearing. Its weakness is the possibility that the local officials will fail to levy the necessary taxes in a particular year. This weakness is more theoretical than real. The good faith of the community usually prompts the performance of the necessary acts. Many government obligations are subject to this criticism.

Temporary Borrowing.—These obligations are issued in anticipation of permanent financing or in anticipation of the collection of ordinary annual operating taxes.

General Discussion

Ad valorem taxes are levied upon the basis of value against all of the taxable property in the municipality.

Benefit taxes or special assessments are enforced contributions from land owners for enhancement of value received by particular properties on account of the construction of a local improvement; for example, a pavement in front of property increases the market value of that property and the benefit tax is levied on account of this increase.

Excise taxes are levies made upon commodities and from an entirely distinct basis of taxation from either of the two foregoing methods. The most

Editors Note: The author of this article specializes in municipal bond law.

conspicuous in this class of taxes so far as municipal bonds are concerned at the present time are water and other utility revenues. There is a growing tendency to issue bonds in anticipation of the collection of these revenues. It is probably safe to anticipate that this type of revenue is as certain as property value. The consumption of water in a given community is probably dependent upon practically identically the same elements as those which produce value to property, to wit, population and industry. Whether gasoline taxes, license fees and the like are sufficiently stable to warrant their anticipation by long-time obligations may be open to some argument.

Improvements may be constructed by the use of more than one type of financing. Some municipalities may construct a water works improvement by the use of ad valorem tax bonds which constitute an unlimited obligation of the entire municipality, by the use of special assessments levied upon benefited property, or by revenue bonds which will be payable only out of revenues to be derived from the completed improvement. Which of these methods should be used is for the determination of the corporate authorities. The factors which should influence their decision are the cheapest net cost of the improvement and the conservation of the debt incurring power of the municipality for other needed improvements which must be paid for by the full faith and credit obligations of the municipality.

A particular type of security in a given state may be in bad repute due to defects in the law authorizing the issuance or otherwise. As far as possible municipalities should avoid the use of any type of security which is thus depreciated. It is always desirable to issue the most marketable type of security in order that the best price may be obtainable therefor and the net cost of the improvement reduced.

A particular improvement may be constructed by a contractor who will take in payment bonds issued therefor, but if it is patent that a small percentage of the par value of bonds actually goes into the construction of the improvement, then it is most unwise to proceed. There is no way to establish an arbitrary percentage of the par value of obligations which should represent cost of labor, material and reasonable contractor's profits, but certainly if less than 75 per cent of the par value of the bonds actually goes into labor, material and reasonable contractor's profits, the municipality should seriously consider deferring the construction of that improvement.

Factors Affecting Value of Bonds.—The value of municipal bonds and the reputation of the issuing municipality would be aided if the corporate authorities seriously considered the necessity of a contemplated improvement and ordered its construction only when it is patent that the improvement is necessary and that the type and design selected are adequate for the needs but are not extravagant. Certainly the construction of a schoolhouse, city hall or any other improvement far in excess of needs, either as to size or elaborateness, affects the price which may be obtained for that issue, and may ultimately affect the credit of the municipality. It also imposes an unreasonable burden upon the tax payers. To avoid these excesses many states have imposed limits upon the amount of indebtedness which the municipality may incur.

Other important factors in the value of municipal bonds are the time and manner of payment. There is a well developed tendency to so arrange the maturities of the bonds that the issue will be fully paid before the usefulness of the improvement is exhausted, and to make the principal payable in instalments over a period of years. This requires the tax payers using the improvement to pay for it and avoids the necessity of accumulating sinking funds.

The experience with sinking funds has not been entirely satisfactory. Sometimes the sinking fund is misappropriated or lost, and sometimes it is not even collected. If it is collected it is impossible to invest the sinking fund in desirable securities which will produce interest at as large a rate as that being paid on outstanding bonds; consequently it is preferable to so arrange the maturities of the bonds that the amount of taxes paid annually on account of said bonds will be about the same each year.

In conclusion it is submitted that in the financing of any municipal improvement effort should be made to issue that type of obligation which will provide the cheapest financing, constitute a reasonable tax burden and not embarrass the municipality in its ordinary operations or in its future developments and will be fully paid within the lifetime of the improvement.

Care should be taken to see that all proper safeguards are provided in the law authorizing the issuance so as to encourage purchasers and thus give a broader market for the securities. These safeguards must consist of two elements: (1) Provisions encouraging and enforcing integrity of municipal officials in the administration of the funds and the prompt collection and application of taxes for the payment of obligations, and (2) The most liberal requirements with respect to the amount and certainty of collection of taxes sufficient to pay maturing principal and interest. As to the value of a particular security, the reputation of the issuing body, its population, value and relationship between indebtedness and value and limitations affecting the amount of indebtedness must all be considered.

Methods of Financing Constantly Changing.—It must be remembered that modes of financing are continually changing. Municipalities should readily avail of all new and improved methods of financing which will add value; for instance, where there are overlapping taxing districts a coordination of their financing will prevent overloading the market and thus increase the sale value of their securities. When it becomes advantageous to finance a particular type of improvement such as road construction from the sale of securities payable from gas taxes and license fees, that method should be adopted, particularly in those communities where the burden of taxation to pay general obligation bonds affects land values.

A contractor or municipal official would do well to employ competent counsel to explain fully the operation of any existing law under which it is proposed to construct an improvement so that he may know exactly where he stands before contracts are made.

Municipal Golf Courses in New York State

According to the City Record, the official publication of the city of Boston, Mass., five cities in New York State operate municipal golf courses. New York City has six courses; Buffalo has four; Rochester has three; Syracuse has two, and Niagara Falls one. Ten of these sixteen courses have eighteen holes and six have nine holes. The sizes of the eighteen-hole courses range from 72 to 305 acres, and for the nine-hole courses from 30 to 79 acres. The 1927 cost of maintaining the six courses in New York City was approximately $100,000; the revenues from fees, lockers and concessions for the golf season was about $212,000. The cost of maintaining the three courses in Buffalo for 1927 was $45,000 and the revenues $30,000; in Rochester the three courses cost $19,690 to maintain and produced a revenue of $39,126; the two courses in Syracuse cost $3,631, with a revenue of $10,375; and the cost of maintaining the course in Niagara Falls was $15,000, with a revenue of $13,000. The number of persons using the New York City links was about 272,000; the Buffalo links, 30,000; the Rochester links, 118,890; and the Niagara Falls links, 29,375.

The fees charged for use of links in New York City were $10 a season or $1 a day; in Buffalo 50 ct. per round on three of the courses, and $25 a year, or 50 ct. a round, on the other course; in Rochester $7.50 a season or $1 per day; in Syracuse 35 ct. on week days, 50 ct. on Sundays and holidays; in Niagara Falls $10 a season or 50 ct. a day. In New York City a locker charge of $10 to $20 is made, and in Buffalo a charge $5 per year for lockers. All these cities have clubhouses, except Niagara Falls, and New York, Buffalo and Syracuse have showers.

Natural Basins Flooded to Increase Flow of Supply Wells

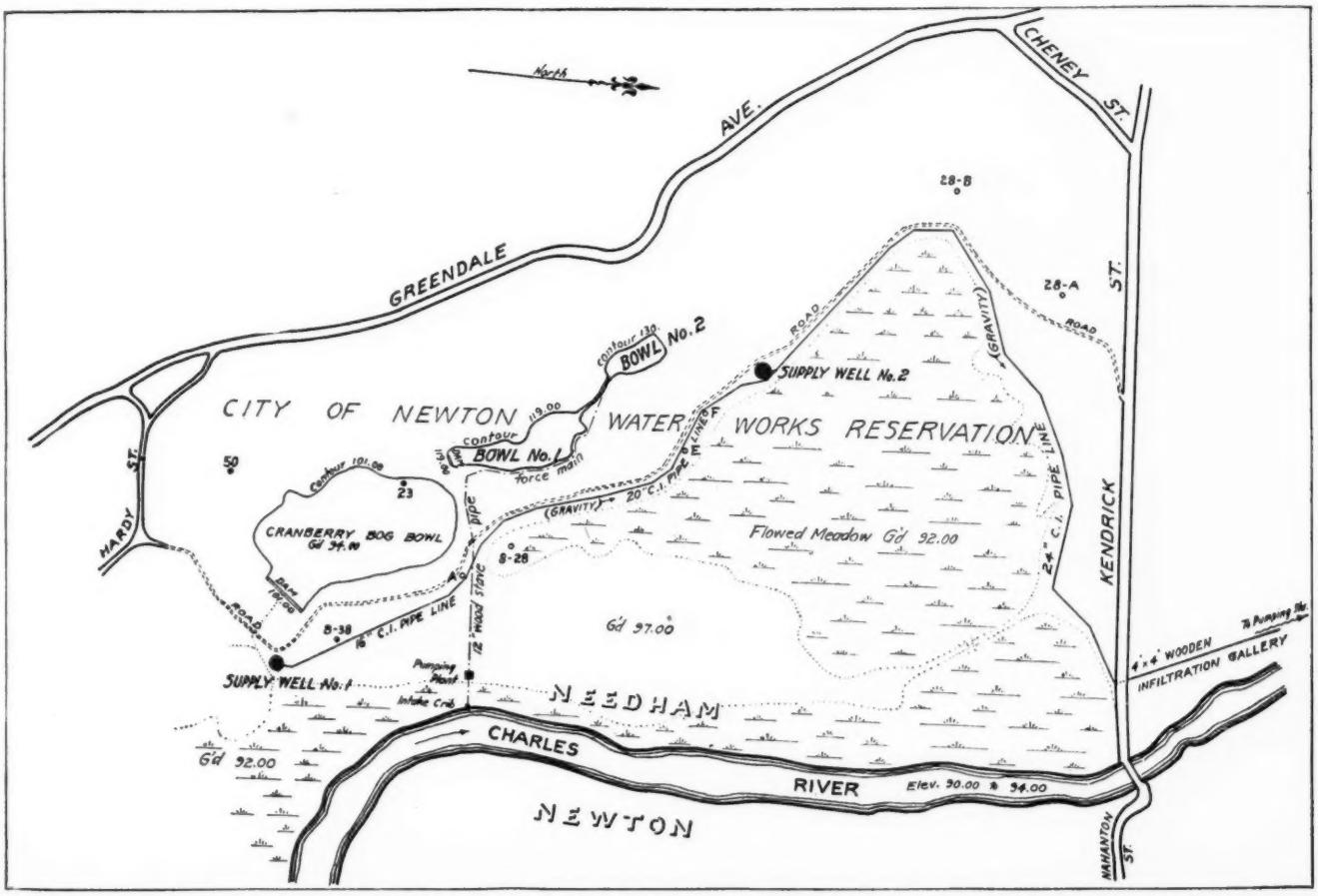
Newton, Mass., Adds to Water Supply by Ingenious Method

DURING the year 1928 the city of Newton, Mass., was confronted with the problem of securing an additional water supply. The water supply of the city is obtained largely from two large concrete supply wells situated in the meadows on the westerly side of the Charles River. These wells intercept the ground water which flows from the higher lands to the west toward the lower levels of the Charles River valley and deliver it to the city mains. The presence of certain natural bowls or basins in the higher land just west of the wells suggested the possibility of increasing the flow of the wells by flooding the basins with water from the Charles River.

Natural Reservoirs Suggested.—Many borings and excavations conducted in the area occupied by the basins indicated that the underlying strata were composed of gravel and sand of such a texture as to furnish ready communication between the surface and the levels reached by the wells. This conclusion was confirmed by the rapidity with which surface water in the basins was observed to drain away into the ground. Thus it was anticipated that the scheme of filling the bowls with river water would be successful. The expense would not be great, as it would be necessary only to locate the basins to be used far enough from the wells to assure proper filtration and to remove surface materials and the top layers of soil. It was thought also that the quality of the supply pumped from the wells would be improved by the addition of the soft river water to the somewhat harder ground water. Again, it was considered that the action of air and sunlight upon the stored water would aid considerably in its purification. The additional storage capacity secured would not be limited to the volume of the basins flooded, but would consist also of the very appreciable capacity of the ground beneath the bowls.

Scheme Applied on Experimental Scale.—The accompanying map of the Newton water-works reservation shows the layout of river, wells and natural basins. It was decided to experiment first with the basin known as Bowl No. 1. This bowl is situated about 1,200 ft. back from the Charles River. The underlying strata of sand and gravel were covered with a layer of loam varying in depth from 2 to 5 ft., and it was first necessary to strip this soil. Accordingly an area 40 ft. wide and 700 ft. long in the bottom of the bowl was uncovered. The material was removed by a steam shovel and cast to the side of the trench so that it might be removed later if it was decided to carry the work beyond the experimental stage. This work, which involved the handling of 5,000 cu. yd. of material, was done for a contract price of $1,000.

A pump well was installed at the river and a line of 12-in. wood stave pipe was laid to the bowl. Pumping equipment consisted of an 8-in. centrifugal pump driven by a 20-hp. motor



Needham Water Works Reservation, City of Newton, Mass., Showing the Two Supply Wells, the Two Bowls and the Supply Line Leading from the Charles River

and capable of pumping approximately 1,400,000 gal. per day against a head of 50 ft. The pipe line, which had a total length of 950 ft., was laid at a total cost for labor and materials of about $2 per ft.

Flow Increased Appreciably.—Pumping of the river water was begun on Feb. 16 and, beginning with this date, the daily output of each of the supply wells was carefully measured. In addition, numerous tube wells were observed to determine the effect of flooding the bowl upon the level of the ground water. On Feb. 18 an increase in the flow of the supply wells was noticed, and it was observed that the ground water had begun to rise in the tube wells. The normal output of Well No. 1, as determined before the experimental flooding of the bowl, was about 800,000 gal. per day. The output of Well No. 2 was about 1,160,000 gal. per day. After ten days of pumping water into the bowl, an increase of 230,000 gal. per day in the output of Well No. 1 was noted, while the increase shown by Well No. 2 was about 550,000 gal. per day. Thus the total increase in the supply furnished by the two wells was about 40 per cent. During this period, the rate of flow into the bowl was 1,400,000 gal. per day. The increase of 780,000 gal. per day in the flow of the two wells gives a recovery of water pumped of about 56 per cent. Analyses of samples of the water showed a satisfactory quality. The experiment was deemed successful, and preparations were made to continue with the excavation and flooding.

Second Basin Stripped.—Excavation of the remainder of Bowl No. 1 was begun in July and completed in the fall. This bowl has a capacity of 6,000,000 gal. when filled to El. 119, and at this level the water covers an area of about 1.8 acres. Bowl No. 2, excavated at the same time, is much smaller, having a capacity of about 1,500,000 gal. when filled to El. 130. The area covered at this elevation of water is about 0.65 acres. Comparison of the added daily flow of the wells with the capacity of the bowls gives an idea of the rapidity with which the water drains away through the porous strata below the surface. About 14,500 cu. yd. of surface material were stripped from the two bowls at a cost of $9,500.

The total length of wood stave pipe line supplying the two bowls is now 1,730 ft. A concrete intake crib is being constructed at the river. A 24-in. vitrified pipe line leads to a pump well situated about 150 ft. back from the river bank. New pumping equipment consists of a 10-in. centrifugal pump, driven by a 50-hp. motor. This pump can deliver 3,500,000 gal. per day against a head of 60 ft.

Observations at the tube well marked 8-28 on the map showed that a large portion of the water not recovered by the two supply wells came to the surface in this vicinity, indicating that this would be a favorable site for a third supply well.

Contracts for stripping the bowls were executed by the John MacDonald Construction Co. The pipe line and pumping equipment were installed by the city water department. E. H. Harvey, designing engineer with the engineering department of the city, was in charge of the work. George A. Sampson, of Western & Sampson, Boston, Mass., is consulting engineer. W. P. Morse is city engineer of Newton.

Soft Water in the Dakota Sandstone

The geologic formation known as the Dakota sandstone, which underlies most of South Dakota and large parts of several other states, is well known for the thousands of flowing wells which it supplies and for the great artesian pressure that was formerly exerted on the water in these wells. The strongest well originally had pressures ranging from 100 to more than 200 lb. to the square inch and would throw up jets of water to heights of 100 ft. or more. Many of the wells that tap this sandstone are still flowing but with greatly reduced pressure, and some have ceased to flow.

Hard and Soft Water in Same Sandstone.—The Dakota sandstone is remarkable not only for the artesian pressure of its water but also for the variety of water that it contains, some of the water being very hard and some very soft. As a rule the upper strata contain soft water, and the lower strata contain hard water. In some places, as at Canton, South Dakota, and in large parts of western Minnesota, the Dakota sandstone rests on the irregular ancient land surface of hard pre-Cambrian rocks such as quartzite or granite. In some of these places the lower part of the formation is absent, and only the upper soft-water strata are encountered in drilling.

The hard water is generally very hard and otherwise highly mineralized, so that it is very unsatisfactory for washing or for use in steam boilers. Much of it is also unsatisfactory for drinking and cooking, but it is generally used for irrigating lawns and gardens. Some of the soft water is of good quality, being not only excellent for washing but also satisfactory for drinking and cooking, use in steam boilers, and irrigation. Much of the soft water, however, contains so much common salt and soda that it is disagreeable to the taste and deadly to vegetation and causes foaming when used in steam boilers. All of the water, both hard and soft, is considered especially desirable for live-stock supplies. The dissolved salts are apparently not unwholesome to the domestic animals, and the relatively high temperature of the water, which comes from great depths, makes it especially attractive and beneficial to them during the long cold winters.

Soft Water for Tub Night and Wash Day; Hard Water Rest of Week.—Some interesting local problems are created by this variety in the quality of the water. For example, at Ellendale, N. D., both hard and soft water were formerly supplied by the city waterworks. From Saturday night to Monday night the smaller supply of soft but rather salty water from the upper part of the Dakota sandstone was pumped into the system to furnish water for toilet and laundry uses, but later in the week the hard water from the deepest well was pumped into the system and was used for sprinkling lawns and irrigating gardens.

The experience at Canton, S. D., affords an example of a somewhat different problem. Here adequate quantities of hard water have for many years been pumped from shallow dug wells in gravel deposits for the city supply and the Government asylum. It was known, however, that soft water, satisfactory for every use, occurs in the Dakota sandstone at a depth of about 300 ft., and wells were drilled to recover this desirable supply. Unfortunately, the sandstone at this place, as in many other localities, is so fine grained and incoherent that the wells give trouble when they are heavily pumped, and it is difficult to recover large supplies.

Water Supply Problems Studied by Government.—The problems of the Dakota sandstone and of other water-bearing formations in the region in which it exists have been given much study by the Geological Survey of the United States Department of the Interior as to the quality of the water, decline of artesian pressure, methods of preventing waste, and methods of finishing wells so as to obtain large supplies without pumping sand. Recently a study was made of the problems at Canton, South Dakota, especially in regard to the Government water supply, and a brief report (Water-Supply Paper 597-C), prepared by O. E. Meinzer, has been published in which the studies at Canton are applied to the general problems of the Dakota sandstone. The report presents data as to the occurrence of soft water in an area where its existence has not until recently been known and calls attention to the possibilities of finding it in other localities in this general region in which at present only hard water is obtained. It presents, almost for the first time in hydrologic literature, detailed information as to the performance of wells in a sand whose physical and hydrologic properties were determined in the laboratory. It was prepared especially for the information of the water-well drillers of the Northwest in improving the water supplies of that region. The author considers the drillers his colaborers, for they have contributed generously to this and other investigations.

Court Decisions on Sanitary Matters

Recent Rulings of State Courts

MUNICIPALITIES Held Liable for Nuisance Caused by Sewer and Sewage Disposal Plant.—(New Jersey Court of Errors and Appeals; Ennever et ux. v. Borough of Bergenfield et al., 144 A. 809; decided Feb. 14, 1929.) An action was brought against certain municipal corporations to recover damages for injuries to plaintiff's property, resulting from the construction and operation by the defendants of a joint sewage-disposal plant and a joint sewage system. A jury found that the disposal by the municipalities of sewage into a small stream which flowed through plaintiff's land created a nuisance, and returned a verdict for the plaintiffs. The court of errors and appeals affirmed the judgment of the lower court, basing the liability of the defendants on the fact that, although they "were performing a public duty in constructing and operating the sewers and the disposal plant," they "were committing an active wrong, thereby causing special damage to the plaintiff's property."—Public Health News, April 26, 1929.

Construction of Statute Concerning Disposal of Dead Animals.—(Iowa Supreme Court; State v. Redlinger, 224 N. W. 83; decided March 12, 1929.) Section 2761, Code 1924, provided as follows:

> No person caring for or owning any animal that has died shall allow the carcass to lie about his premises. Such carcass shall be disposed of within 24 hours after death * * *.

By section 2762 a violation of the above section was made punishable by fine or imprisonment.

In a prosecution under the statute the defendant argued that the indictment charged more than one offense. In passing on this claim the supreme court had the following to say regarding its interpretation of the enactment:

> * * * Plainly the law is violated when the person caring for "any animal that has died" allows "the carcass to lie about his premises" for 24 hours without disposing of it as required. Thereby such person subjects himself to the penalty prescribed by section 2762. At the end of the 24 hours the offense is complete. * * * It was not intended to inflict a penalty for permitting a dead animal to remain uncared for for an hour or 10 hours but for 24 hours. * * *—Public Health News, May 3, 1929.

Authority of State Department of Health Sustained in Stream Pollution Case.—Authority of the Ohio State Department of Health to prevent stream pollution by order to a municipality that it cease the discharge of sewage into a stream was sustained by the full bench of the Ohio Supreme Court in a decision handed down April 24, 1929, in a case brought against the Department by the city of Bucyrus. The opinion was written by Judge Robinson.

This is a case (City of Bucyrus vs. Department of Health) wherein the city of Bucyrus contested the authority of the Department of Health to issue an order requiring the city to cease the pollution of the Sandusky river by the discharge of sewage into that stream. The order of the Department of Health was made Dec. 14, 1928, and this action was filed in the Supreme Court within the time limit fixed by statute. The petition of the plaintiff set forth many points on which error was claimed in the proceedings of the Director of Health and the Public Health Council, including the following:

> That as no complaint in compliance with Sec. 1249 G. C. had been filed with or presented to the Department of Health, the Director was without right or authority to make his finding.
>
> That sufficient evidence was not presented to sustain the finding and its approval, and the determination of the Public Health Council that the city be required to make certain changes and improvements; but that they were contrary to law, unlawful and unreasonable.
>
> That there was not sufficient evidence to sustain the order of the Director and its approval, and that they were unlawful and unreasonable.
>
> That there was error by the Council in proceeding over the protest of the city of Bucyrus; that it acted without sufficient evidence before it; that it considered matters outside the record, and that it refused to require proof as to sufficiency of the complaint on which the Director acted.
>
> That the sections of the Code under which the Director acted are unconstitutional, null and void, as being in conflict with the constitutions of both State and Nation.
>
> That the act of the General Assembly, passed April 7, 1908, entitled "An Act to authorize the State Board of Health to require the purification of sewerage and public water supplies and to protect the streams against pollution," with its amendments, so far as it relates to matters other than public water supplies, is not an enactment to protect the public health; is not an exercise of the police power of the State, and confers no jurisdiction on the Department of Health in this proceeding.
>
> That all the acts and orders of the Department of Health, the Director of Health and Public Health Council were made in violation of evidence, in an ex parte, summary and arbitrary manner, apparently under the influence of passion and prejudice, and therefore were unlawful and unreasonable.
>
> That due process of law was denied the plaintiff in error.

All these objections were brushed aside in the decision of the Court, which declared in specific terms that the so-called "Home Rule" amendment to the Constitution in no way curtails the sovereignty to the State over Municipalities in respect to sanitation for the promotion or preservation of the public health. The approved syllabus of the decision of the Supreme Court is as follows:

1—The provisions of Article XVIII of the Constitution of Ohio do not deprive the State of any sovereignty over municipalities in respect to sanitation for the promotion or preservation of the public health which it elects to exercise by general laws.

2—The holdings of this Court in the case of State Board of Health v. Greenville (86 Ohio St., 1), are as applicable to municipalities since the adoption of Article XVIII as they were before the adoption of that Article, and will be adhered to.

3—The report of an investigation required by Section 1249, General Code, is competent evidence at a hearing provided for in Section 1250, General Code, but is not conclusive, and the persons securing the data are subject to cross-examination and impeachment.

Opinion written by Judge Robinson, and concurred in by Marshall, C. J. Kinkade, Jones Matthias, Day and Allen, JJ.

On the same day the Supreme Court overruled the demurrer of the city of Delphos to a petition by the Department of Health for a writ mandamus to compel that city to comply with an order of the Department requiring the city to make certain changes and improvements in its methods of handling sewage, for the prevention of stream pollution. Grounds of the demurrer by the counsel for the city of Delphos were substantially the same as the basis of argument by counsel for the city of Bucyrus.—Ohio Health News, May 1, 1929.

Keeping of Swine and Dumping or Leaving Garbage in Town Restrained. — (Massachusetts Supreme Judicial Court; Inhabitants of Swansea v. Pivo, 164 N. E. 390; decided January 5, 1929.) The board of health of the town of Swansea adopted the following regulations:

> No person, firm or corporation shall keep or maintain within the limits of the town six or more swine over 3 months of age without a permit from the board of health.
>
> No person, firm or corporation shall deposit, dump or leave within the limits of the town any swill or garbage without a permit from the board of health and in such case in no place other than that fixed by the board and described in such permit. * * *

Thereafter the defendant kept a large number of swine in the town without a permit from the board of health and in violation of the regulations. The board of health, acting under statutory authority, then directed the issuance of an order of prohibition against the defendant, having already determined that the keeping of swine and the dumping or leaving of garbage by the defendant was dangerous to the public health and a nuisance. The defendant failed to obey the order and suit was brought by the town to restrain him. A decree, entered in favor of the town, was affirmed by the supreme court. Points determined by the appellate court are set forth in the quotations from the opinion, which follow:

> The [master's] report discloses, it was admitted by the plaintiff, that the records of the meeting held on July 8, 1927, when the regulations were adopted, and the records of the meeting of November 21, 1927, when the order of prohibition was voted, were amended by the clerk of the board of health the latter part of November or the first part of December, 1927, and that the amended records were signed by the clerk of the board. The master further found that "the amended records, * * * in evidence, are a true record of what took place at the meetings named." The records as amended plainly show that the regulations and order of prohibition were duly adopted. The clerk had power to amend his original records to conform to the truth. The amendments thus made became a part of the record and the whole record is to be considered as such. * * *
>
> The town may maintain a suit in equity to enforce regulations adopted by its board of health, under the provisions of G. L. c. 111, sections 31, 122, 143; * * * As the original

records were inaccurate and defective, it was within the power and was the duty of the clerk to amend them. It could be shown by a member of the board that the amended records were accurate. * * *

The defendant made an offer to prove that the board of health acted in bad faith in issuing the order of prohibition, and offered to show that the acts complained of did not constitute a nuisance and were not injurious to health. This evidence was rightly excluded. The proffered proof is not admissible in these proceedings. * * *

"The determination of the board of health is not a merely ministerial act; but is quasi judicial, in the sense that it is not to be contested or revised, except in the manner provided in the statute. * * *"

* * * It does not appear that any special authorization to continue the trade or employment pending this suit was given under G. L. c. 111, sec. 148.—Public Health News, March 15, 1929.

Sprinkler System for Curing Concrete Pavements

The accompanying photographs illustrate the scheme employed by W. F. Pigg & Son, Inc., contractors, Denver, Col., for curing concrete on their city paving jobs. By the adoption of this system, concrete curing costs are stated to have been cut to less than one-half the cost of puddling or sprinkling with hoses.

A 2-in. pipe line is placed down the center of the pavement, where the width is 25 ft. or less. For greater widths, two or more lines are used. Sprinkler heads are installed approximately every 20 ft. Where a fire hydrant is available, the pipe line is connected to the plug; in a section where there are no hydrants, it is necessary to use a force pump. With one fire hydrant working at a pressure of approximately 60 lb. per sq. in., it is possible to cure a section 25 ft. wide and approximately 1,000 ft. long. For larger areas, more plugs may be connected in. The sprinklers are operated only intermittently, the water being turned on for a period of about one minute every 10 to 15 minutes. The sprinkling period is, of course, variable —more water being required on hot days and less on cloudy days.

Consumption of water and the cost of labor are both much less where this method is used in preference to covering the pavement with moist earth or building earth dikes and flooding the surface, the contractors state. A boy, or a laborer paid a small wage, can handle an enormous section of finished pavement.

A patent on this method of curing pavements is pending.

One of the Sprinkler Heads

Curing a Concrete Pavement by Sprinkling

Monterey's Municipal Rose Garden

By FRANCIS E. LESTER

President, Monterey Chamber of Commerce

The municipal rose garden in Monterey, Calif., is just now in its fullest glory. More than 1,200 rose bushes are in bloom and the planting plan, which produces the maximum of mass color effects, displays these blooming bushes to the greatest advantage.

Visitors are found in the garden daily from many remote points; during a recent week, visitors to the garden included groups from Seattle, San Diego and Denver.

The garden was started by the city of Monterey a year ago, when a small part of the planting was done; but most of the roses have been planted this spring. The garden contains about 1,400 roses—more than 200 varieties of bush roses, over 60 varieties of climbing roses, 20 varieties of pillar roses and about an equal variety of standard or tree roses. Some of these latter are budded with three harmonizing colors on the stem.

A lily pool is in the center of the garden, ringed around by tree and baby roses. Surrounding this central feature are the mass plantings of red, pink, yellow, and new-bud roses. One beautiful bed contains fifty of the new single Vesuvius rose, a deep flaming scarlet, which is now in full bloom.

A unique feature of Monterey's municipal rose garden is that it is within two blocks of the business center of the town. It adjoins historic Colton Hall, first state capitol of California, and on all sides of the garden the visitor encounters historic landmarks such as the residence of General Fremont in 1847; the residence of Governor Alvarado; the "House of the Four Winds," and the former home of Thomas Larkin, first American consul.

In one of the most interesting spots in the garden is the planting, in adjoining beds, of the old and the new roses. Among the old roses are found examples of many roses no longer in commerce, originations of centuries ago, such as the York and Lancaster, the old Blush and several varieties of the Old Norse Roses. Oldest of all, and perhaps most interesting, are the two bushes of what is known as the Ancient Rose—identically the same rose that grew in the days of Greece and Rome. Immediately across the walk are examples of the very latest and finest roses, thus illustrating what the rose hybridist has accomplished in the development of the present-day rose of such exquisite form and marvelous coloring. In one corner of the garden are found plants of the species of parent roses, from which all hybrid roses have been created. Another corner is planted with the sweetbriers; another with the Austrian briers which gave to the hybridist the yellow tones found in the modern rose.

In one corner is a rose found in no other municipal rose garden in the world—the Father Junipero Serra Rose, created by Rev. Father Schoener of Santa Barbara and presented to Monterey's Municipal Rose Garden. There are many other interesting features of the garden to be found by the visitor.

Everything in the Monterey municipal rose garden is plainly marked with the name and date of origin. The beds are so arranged that every rose is easily seen from an adjoining walk or pathway.

The main approach to the garden is underneath a series of twelve arches, each arch planted with two similar climbing roses. Among these are found examples of the old roses of Monterey, including the famous Sherman Rose and other old roses no longer in commerce.

The financing of the garden and its perpetual maintenance are provided for by the city government, and the great number of people who have visited it in the past few weeks is a striking indication of their appreciation of the vision and foresight of the city authorities in providing for Monterey this, its chief beauty spot.

Taxes Paid Through Banks.—A new tax collection plan is now in force at Baltimore, Md., which allows payment of taxes through neighborhood banks.

Design of Sprinkling Filter Distribution Systems

A System for Calculating Pipe Sizes

By ANSELMO F. DAPPERT and W. H. WISELY
Assistant Sanitary Engineers, State Department of Public Health, Springfield, Ill.

FOR convenience in checking plans and to simplify the process of calculating pipe sizes for the distribution system which ordinarily involves laborious trial and error methods, we have developed a system which we believe to be positive and which eliminates most of the usual required assumptions.

In the formulas which we have developed there is only one item for which we need to apologize and that is the assumption that the friction coefficient for the same diameter pipe and the velocities which ordinarily prevail in a distribution system, are constant. This assumption is not quite true but from several detailed calculations we have shown it to be satisfactory for all practical purposes.

Under the usual assumption that there is no variation in the quantity of liquid supplied to the various nozzles and laterals, the loss due to entrance into any lateral or nozzle riser is the same as for any other lateral or nozzle riser. This being accepted, the maximum loss of head will occur in the nozzle farthest removed from the dosing tank. To be on the safe side it is customary to provide that the total loss of head calculated from the farthest removed nozzle to the dosing tank shall not be more than the total loss allotted to the distribution system.

The actual total loss in a distribution system can therefore be laboriously determined by calculating the frictional losses in each section of the lateral between nozzles, in each section of the main between laterals, in the section of main between the filter bed and siphon, the entrance losses into one lateral and one nozzle riser, and taking their sum. The losses through reducers are negligible.

In a main or lateral of uniform diameter, there is a certain equivalent quantity which if flowing throughout the entire length of main or lateral will produce a frictional loss of head equal to the sum of the actual frictional losses in each section of the main between laterals or in each section of a lateral between nozzles. The same is true for any section of a compound main or lateral. The problem therefore, is to determine the above equivalent quantity.

Two General Cases.—There are two general cases as follows:

(A) A main with two-way laterals. (Note that we designate a lateral as any pipe which supports nozzles and projects laterally from the main.)

(B) A main with one-way laterals or a lateral supporting a single row of nozzles.

Without going into the derivation of our formulas but with the statement that we can furnish any one interested in the subject with the proof we will state that

$$(1)\quad X = \frac{2\,(2^2+4^2+6^2\ \ldots\ +N^2)}{N}$$

(For main with two-way laterals.)

$$(2)\quad Y = \frac{1^2+2^2+3^2\ \ldots\ +N^2}{N}$$

(For main with one-way laterals, or a lateral.)

where X = the number by which the discharge for one lateral should be multiplied to ascertain the equivalent quantity flowing in a main with two-way laterals.

Y = the number by which the discharge for one lateral (or one nozzle as the case may be), should be multiplied to ascertain the equivalent quantity flowing in a main with one way laterals, (or in a lateral, as the case may be).

N = the number of laterals (or in Equation 2, the number of laterals or the number of nozzles as the case may be).

In a compound main serving 2-way laterals, equivalent quantities flowing must be determined for each separate section of the compound main. Where x_1 x_2 etc. = the number by which the discharge for one lateral should be multiplied to ascertain this equivalent quantity flowing in the largest, next to the largest, etc. section of the main, and N_1, N_2, N_3, etc. = the total number of laterals in the bed, the total number of laterals less the number of laterals tributary to the largest section, the total number of laterals less the number of laterals tributary to the largest and next to the largest sections, etc., X_1 X_2 etc. should be substituted for X and N_1, N_2, etc. substituted for N in Formula No. 1.

In a compound main serving one way laterals or in a compound lateral, equivalent quantities flowing must be determined for each separate section of the main or lateral and in formula No. 2, Y_1 Y_2 etc. should be substituted for Y and N_1, N_2, etc. substituted for N.

Values for X and Y.—Tables I and II have been prepared giving values of X and Y for various values of N as computed from Formulas Nos. (1) and (2).

The use of the above tables will be made clear by the following examples, in which a cast-iron pipe nomograph has been used for determining pipe diameters and head losses.

Use of Tables—Example I.—A filter has been designed up to the point of determining pipe sizes and the following data are established:

(a) Allotted loss for distribution system = 0.5 ft.
(b) Size siphon = 24 in.
(c) Main with 24 laterals (2-way) spaced at 8.5 ft.
(d) Distance from siphon to a point 8.5 ft. from first pair of laterals = 30 ft.
(e) Equivalent of 10 full ⅞ in. Taylor circular nozzles on 2 in. risers spaced at 9.83 ft.
(f) Discharge for one nozzle at maximum net head = 17 g.p.m.

1. The siphon size (24 in.) will be carried to a point 8.5 ft. from first pair of laterals. Loss in 30 ft. of 24 in. flowing $17 \times 10 \times 24 = 4080$ g.p.m. is 0.042 ft. We now have $0.5 - 0.042 = 0.458$ ft. as the allotted loss in the remainder of the distribution system.

2. For economical design we will allot about 75 per cent of the loss to the laterals and the remainder to the main. On this basis we will allot $0.25 \times 0.458 = 0.1145$ ft. loss to the main

$$= \frac{0.1145 \times 100}{12 \times 8.5} = 0.112 \text{ ft.}$$

per 100 ft.

3. From Table I for $N = 24$, $X = 14.7$
$14.7 \times 10 \times 17$ = equivalent quantity = 2500 g.p.m.

4. For a loss of 0.112 ft. per 100 ft. and a flow of 2500 g.p.m. a 21 in. main is required. The nearest commercial size is 20 in., so we will make the main of a uniform diameter of 20 in. from a point 8.5 ft. from the first pair of laterals, putting in a reducer at the designated point.

5. The loss in $12 \times 8.5 = 102$ ft. of

Table I. (For main with two-way laterals)

N=	4	6	8	10	12	14	16	18	20	22	24	26	28	30
X=	3.16	4.31	5.48	6.64	7.79	8.85	10.1	11.3	12.4	13.6	14.7	15.9	17.0	18.2

Table II. (For main with one-way laterals, or a lateral)

N=	3	4	5	6	7	8	9	10	11	12	13	14	15
Y=	2.16	2.74	3.32	3.88	4.47	5.0	5.58	6.16	6.75	7.32	7.90	8.50	90.7

20 in. main flowing 2500 g.p.m. = 0.143 ft. We now have 0.458 — 0.143 = 0.315 ft. as the loss to be allotted to the lateral including the entrance losses to lateral and nozzle riser. Ordinarily these two entrance losses will amount to less than 0.1 ft. so we have 0.315 —

$$0.1 = 0.215 \text{ ft.} = \frac{0.215 \times 100}{10 \times 9.83} = 0.219 \text{ ft.}$$

per 100 ft. as the frictional loss to be allotted to the lateral.

6. From Table II for N = 10, Y = 6.16.

6.16 × 17 = equivalent quantity = 105 g.p.m.

7. For a loss of 0.219 ft. per 100 ft. and a flow of 105 g.p.m.; a 5.8 in. lateral is required. Therefore we will use 6 in. laterals.

8. Our layout now comprises a 24 in. main extending from the siphon to a point 8.5 ft. from the first pair of laterals, a 20 in. uniform main in the bed, and 6 in. uniform laterals. We should now check the actual losses to be certain that the calculated losses for the system conform to the allotted losses.

Entrance loss to nozzle riser	= 0.024 ft.	
Entrance loss to lateral	= 0.030 ft.	
Loss through reducer neglected	= 0.000 ft.	
Loss in 30 ft. of 24 in. Main	= 0.042 ft.	
Loss in 102 ft. of 20 in. Main	= 0.143 ft.	
Loss in 98.3 ft. of 6 in. lateral	= 0.170 ft.	
Actual total distribution system loss	= 0.409 ft.	
Allotted distribution system loss	= 0.500 ft.	O.K.

The same actual total distribution system loss can be obtained by taking the sum of the two entrance losses, the separate losses in each section of the main between laterals and in each section of the lateral between nozzles, and the loss in the main between the siphon and the bed, but this is a laborious process which the system we propose avoids.

To illustrate the use of the above tables in connection with a compound main or lateral we will take the data in Example No. I and design a compound main so that the total loss in the main will be equal to the loss allotted to the main.

Use of Tables—Example No. II.—The 24 in. will be carried as in Example No. I, to a point 8.5 ft. from the first pair of laterals.

Allotted loss to the main = 0.1145 ft. = 0.112 ft. per 100 ft.

1. N_1 = total number of laterals = 24. From Table I for $N_1 = 24$, $X_1 = 14.7$.

14.7 × 10 × 17 = equivalent quantity = 2500 g.p.m.

2. For a loss of 0.112 ft. per 100 ft. and 2500 g.p.m. flowing, a 21 in. main is required, a 21 in. falling ¼ of the distance between a 20 in. and 24 in., above the 20 in. on the pipe diagram. Therefore, we will arbitrarily carry the 24 in. main from a point 8.5 ft. from the first pair of laterals to and including the third pair of laterals, which is ¼ of the total length of the main.

3. The loss in 25.5 ft. of 24 in. flowing 2500 g.p.m. is 0.015 ft. and the loss allotted for the remainder of the main is 0.1145 — 0.015 = 0.0995 ft.

$$\frac{0.0995 \times 100}{(102 - 25.5)} = 0.130 \text{ ft. per 100 ft.}$$

4. For the second section $N_2 = N_1 - 6 = 18$ and from Table I $X_2 = 11.3$.

11.3 × 10 × 17 = equivalent quantity = 1920 g.p.m.

5. For a loss of 0.13 ft. per 100 ft. and 1920 g.p.m. flowing an 18.3 in. pipe is required, 18.3 in. falling 0.3 of the distance between 18 in. and 20 in. above the 18 in. on the pipe diagram. Therefore, we arbitrarily will carry the 20 in. a distance equal to 0.3 of the remaining distance of 76.5 ft. = 22.9 ft. or to a point 5.9 ft. beyond the 5th pair of laterals.

6. The loss in 22.9 ft. of 20 in. carrying 1920 g.p.m. = 0.021 ft. We now have 0.0995 — 0.021 = 0.0785 ft. =

$$\frac{0.0785 \times 100}{102 - 25.5 - 22.9} = 0.146 \text{ ft.}$$

per 100 ft. as the allowable loss in the remainder of the main.

7. For the third section $N_3 = N_1 - 6 - 4 = 14$ and from Table I for $N_3 = 14$, $X_3 = 8.85$.

8.85 × 10 × 17 = equivalent quantity = 1500 g.p.m.

8. For an allowable loss of 0.146 ft. per 100 ft. and 1500 g.p.m. a 16.2 in. is required, 16.2 in. falling 0.2 of the distance between a 16 in. and 18 in. above the 16 in. on the pipe diagram. We arbitrarily will carry the 18 in. a distance equal to 0.2 of the remaining distance of 53.6 ft. = 10.7 ft. or to a point 8.1 ft. beyond the 6th pair of laterals.

9. The loss in 10.7 ft. of 18 in. flowing 1500 g.p.m. = 0.010 ft. We now have 0.0785 — 0.01 = 0.0685 ft. =

$$\frac{0.0685 \times 100}{102 - 25.5 - 22.9 - 10.7} = 0.159$$

ft. per 100 ft. as the allowable loss in the remainder of the main.

10. For the 4th section $N_4 = N_1 - 6 - 4 - 2 = 12$ and from Table I for $N_4 = 12$, $X_4 = 7.79$.

7.79 × 10 × 17 = equivalent quantity = 1360 g.p.m.

11. For an allowable loss of 0.159 ft. per 100 ft. and 1360 g.p.m. a 15.95 in. is required. Therefore, since a 16 in. is so close to the actual required size we will make the remainder of the main a 16 in.

12. Our layout for the main now comprises a 24 in. extending to a point beyond the third pair of laterals, a 20 in. extending to a point beyond the 5th pair of laterals, an 18 in. extending to a point beyond the 6th pair of laterals, and a 16 in. extending to a point beyond the last pair of laterals.

A compound main with one way laterals or a compound lateral can be designed by the same process with the exception that Table II should be used. After the various sizes are determined the losses should be checked to be certain that the total distribution system losses conform to the losses allotted to it.

In Example No. II the calculations have been carried out on the basis of showing that the losses in a compound main can actually be made to equal the predetermined losses for the main rather than on a practical basis. In the same way, the actual losses in a compound lateral can easily be made equal to the predetermined losses allotted to it. To adhere rigidly to the principle of making the actual losses in a compound main or lateral equal to the predetermined allotted losses will not always give practical results, and in order to secure a practical design it will be necessary for the designer to permit some variation in the percentage of the total loss to be allotted to the main or laterals. We consider the result obtained in Example I as practical and economical for the data used.

Acknowledgment.—The foregoing is taken from the April Illinois Engineer, the official publication of the Illinois Society of Engineers.

Cost of Water at Charleston, South Carolina

Some interesting statistics on the cost and income for water delivered to the distribution system of Charleston, S. C., are given in the 1928 report of J. E. Gibson, manager and engineer of the water department. The following table shows the average cost for the period 1921 to 1928 inclusive:

	Per 1,000,000 gal.
Pumping and Distribution:	
Operation and maintenance of mains	$ 8.99
Operating plant, including fuel and purifiers	33.58
Maintenance of machinery, buildings and filters	5.61
General officers, clerical assistants, insurance, legal and office expenses	20.35
Total, general, pumping and distribution	$ 68.53
Fixed Charges:	
Sinking fund and depreciation	19.63
Interest, bonds, loans and taxes	37.48
Interest on surplus invested in plant	19.67
Total fixed charges	$ 76.78
Extraordinary Expense:	
Drought, repairing, repairs, relocation of mains	8.84
Grand total, all expenses	154.15
Gross income from sale of water	167.81

Heavy Oil Tanks Moved on Greased Skids

A Universal crane and a track of well-greased plates were the means of moving two 10,000-gal. oil tanks, weighing 12,000 lb. each, a distance of about 250 ft. recently. The tanks were 28 ft. high and surrounding conditions necessitated moving them in a vertical position. The crane backed up to a tank, the hook block was fastened to the top of the tank and the bottom of the tank was lashed to the rear of the truck frame. When the tank was unfastened at its base, it was supported from the crane boom and skidded along a track of greased plates to its new position. The job cost the oil company $150.

Chlorinated Copperas and Ferric Chloride as Coagulants

A Recent Development in Water Purification Processes

By L. H. ENSLOW

Research Engineer, The Chlorine Institute, Inc., New York City

THE topic on which I am to speak—coagulation—is not new, but I believe the coagulant,—chlorinated copperas,—is new to most of those present. Neither of the components is new, but the combination of them to produce a coagulant is of rather recent development and its practical application in water purification is little more than a year old.

Coagulants.—The oldest known coagulants to be employed by man for clotting suspended particles in turbid water are the alums. The Chinese apparently practiced water clarification with alum before the Christian era. Artificial coagulation with aluminum salts has been materially improved within recent years as a result of a more scientific application and control of influencing factors such as the hydrogen ion concentration, better mixing arrangements and prechlorination of the raw water.

Long before the Chinese applied aluminum compounds artificially as coagulants Mother Nature had supplied the universe with a natural coagulant which contained the elemental substance on which all life is dependent, i. e., iron.

Water Coagulation Unassisted by Man.—In the natural decoloration and clarification of impounded waters it is known that iron and not aluminum is the responsible element. The soil and vegetation thereon contain iron in organic combination. The iron is liberated as ferrous iron as a result of subsequent anaerobic decomposition. In the ferrous state the iron will not precipitate until the surface contact with oxygen containing atmosphere produces ferric iron. In the ferric state the iron will combine with fresh organic coloring matter to produce flocculation and precipitation of the colloidal coloring matters. The reaction is apparently not one dependent upon ferric hydroxide formation and subsequent absorption of coloring matter, but rather consists of the production of a complex compound in which the negatively charged coloring matter is combined with the positively charged ferric iron to produce a bulky floc which settles. On reaching an oxygen deficient zone at or near the bottom of the water body, decomposition again releases some of the iron in the soluble ferrous form. Temperature changes or wind action produces an overturn of the stratified water and the iron again is reoxidized and further precipitation ensues. This cycle repeats to produce color removal and clarification.

Raw Water Prechlorination as an Aid to Coagulation.—Robert Spurr Weston[1] several years observed that color removal by coagulation with alum could be materially improved if the raw water was first chlorinated. His experience also showed that the alum required was thereby reduced. A number of experiences of similar nature have been reported since. Watkins at Norfolk, Va., has effectively employed prechlorination since 1923 and the plant of the Newport News Water Co. was also among the earliest to adopt prechlorination. Prechlorination at Norfolk has made it possible to reduce the alum requirement and thus effect an appreciable economy.

Several explanations to account for the improved coagulation effected by chlorination of raw waters have been advanced. In the writer's opinion, the presence of ferrous compounds in the raw water constitutes at least one valid explanation. The oxidizing effect of the chlorine renders the iron immediately effective as a coagulant whereas in the ferrous state it had no effect. In other words, chlorine does quickly that which nature performs slowly. Alone, the quantity of iron present may be only sufficient to secure "pin point" flocculation, but is sufficient to reinforce the artificial coagulant added and thereby a saving results. The iron oxidation theory seems to explain best the writer's early ideas that prechlorination appeared to serve as an artificial "ageing" process which rendered the coloring matter more readily coagulated. At Wausau, Wis., prechlorination of the raw water containing appreciable ferrous and sulphur compounds has indicated that an alum saving of 33 per cent can be expected.

Artificial Coagulation with Iron Compounds.—Ferrous sulphate ($FeSO_4$:$7H_2O$), known in the chemical trade as "copperas," has been employed in coagulation for many years. Copperas in coagulation work has always been used with lime in order that the ferrous iron will take up oxygen and pass to the ferric state. Because of the high alkalinity necessary (pH 9.0 or higher)[2] ferrous salts have, as a rule, not proved to be satisfactory coagulants for the soft colored waters, or for the soft turbid waters. Both of these types of waters usually coagulate efficiently only in the acid range, i. e., below pH 7.0, and the addition of alkaline material, if practiced, must be carefully controlled.

Ferric Chloride.—Ferric chloride ($FeCl_2$:$6H_2O$) is one of the oldest coagulants known. Its use was in vogue in the early days of chemical precipitation of sewages and is very apt to return to favor. It was employed as a water coagulant to a limited extent also and interestingly enough was used in Holland, under the guidance of Dr. Duyk in 1902, in combination with hypochlorites, thus simultaneously securing prechlorination. The process was termed the "Ferro-chlor Process," and has been favorably reported upon in America by Prof. Geo. C. Whipple.[3] Apparently the lower cost of aluminum sulphate has made the use of ferric salts unattractive. Recently, however, ferric salts have become available at attractive prices and probably their use will return to favor.

The investigations of coagulants by Miller[4] of the United States Public Health Service included ferric chloride and ferric alum in laboratory studies of water coagulation in which it has been shown that ferrous sulphate coagulated only at high alkalinities (pH 9.0 and above) but that ferric chloride coagulated satisfactorily at low alkalinities (pH 5:0) and also at various higher values. Mohlman and Palmer[5] of the Sanitary District of Chicago, in 1925 conducted important investigations in the coagulation of sludge from the activated sludge sewage process. In these studies ferric chloride was shown to be superior to all other coagulants, and functioned at very low alkalinities.

Chlorinated Copperas.—In searching for the cheapest available source of ferric iron it was but logical to consider the oxidation of copper as ($FeSO_4$:$7H_2O$) with liquid chlorine. This was successfully done, and this new coagulant—chlorinated copperas—while slightly less efficient than ferric chloride, proved to be vastly superior to alum in sludge dewatering. The method employed is given in the paper[5] cited. It served admirably at Chicago, was promptly investigated by Houston, Tex., and Milwaukee, Wis., and, with slight modification, was adopted.

The simplicity and the economy with which ferric iron is secured from the

cheapest available iron salt—copperas—and the cheapest and most powerful known oxidizing element known—chlorine—are appealing. The reaction involved is theoretically the following:

$6FeSO_4 + 3Cl_2 = 2Fe_2(SO_4)_3 + 2FeCl_3$

in which one pound of chlorine is required for 7.8 pounds of copperas.

$Cl:FeSO_4 . 7H_2O = 35.46:278 = 1:7.8$

In practice the ratio has proven to be 1 chlorine to 8 copperas.

The First Practical Use of Chlorinated Copperas in Water Purification.—For about one year chlorinated copperas has been in use at Elizabeth City, N. C., for coagulating the difficult and highly colored water from the Great Dismal Swamp area. To succeed with any process so radically new and different required ingenuity, perfection of practical arrangements, and tenacity on the part of L. L. Hedgepath,[7] then superintendent of the Elizabeth City plant. It was the good fortune of the writer to have interested him in experimenting with chlorinated copperas.

Producing Chlorinated Copperas Solution.—The arrangement for producing chlorinated copperas is very simple. It consists of a dry feed machine which delivers copperas to a small baffled solution vat beneath, and a chlorinator. The copperas in solution is conducted by gravity or, where necessary, by an ejector, through a corrosion resistant pipe line to the point of application to the raw water. Just beyond the copperas solution vat chlorine water conducted from the chlorinator is introduced into the pipe line through a rubber hose. Thus the chlorination of the copperas is effected during its passage to the point of application. Knowing the rate of delivery of the copperas required for the coagulant dosage, the chlorinator is set to deliver one eighth as much chlorine. It is better practice to add, as a margin of safety, about 10 per cent more than the theoretical calculated chlorine in order to preclude any possibility of passing ferrous iron into the water. The slight excess chlorine possesses a distinct value in improving plant performance because it serves in the capacity of prechlorination and is, therefore, not to be considerated wasted.

To date no other plants producing potable water have adopted chlorinated copperas on a practical scale. However, at a paper mill in Chicago where the foul Chicago River water is coagulated and filtered, chlorine and ferrous sulphate are producing results superior to the previously employed lime-iron coagulation. At this writing a demonstration is under way at a plant in Alabama.

A number of laboratory scale experiments have been carried on at several plants and almost without exception chlorinated copperas or ferric chloride has produced results which warrant large scale tests. Mr. Watkins of the Norfolk plants and Mr. Baldwin of the Richmond plant have carried out some small scale tests with chlorinated copperas.

General Remarks Concerning Ferric Iron Coagulation.—The range of alkalinity of the treated water in which ferric salts coagulate efficiently is very broad as compared to the ferrous salts or aluminum salts.

Where the removal of larger quantities of coloring matter is the problem the coagulation is most effective with little if any addition of artificial alkalinity. In some instances in connection with industrial waste—notably laundry wastes—addition of acid is beneficial. The optimum for very highly colored swamp waters is within the zone pH 3.8 to 4.7. This range is covered by Brom Cresol Green, and with Methyl Orange will indicate slight acidity to slight alkalinity.

Tannin is precipitated from tanliquors when acidified to a pH value under 4.6 and addition of alkali increases the solubility of tannin. The maximum dispersion occurs at pH 8.2 to 9.2 (i. e., in the normal carbonate range of alkalinity). This explains in part the failure of ferrous salts and lime in organic color removal and the inefficiency of aluminum salts at a pH value above 5.5. It may also explain the difficulty of removing color with alum without, at the same time, producing a filter effluent containing residual alum. At Elizabeth City, for example, the most effective color removal with alum is secured at a pH value not exceeding 4.9. In other instances the optimum is as low as pH 4.0. Under such conditions, aluminum compounds pass the filters.

Where the color removal is not so difficult and the amount is not large, ferric coagulation is effective over a wide range of pH value and in some instances it is possible to secure coagulation, color removal and carbon dioxide elimination with ferric iron and lime or soda at one operation, i. e., at pH values up to 8.2. On the whole, however, it is safer to recommend that color removal be practiced with the minimum required alkalinization or without any, and that pH adjustment to prevent corrosion be practiced after filtration, or just ahead of the filters if the latter practice proves to be more advantageous in securing longer filter runs.

When coagulating soft turbid waters carrying no appreciable soluble color the ferric coagulation is usually efficient at almost any pH value up to and including the point at which the corrosive quality has been corrected by alkali addition.

It seems apparent that in color removal the acidity (low pH value) plays an important role in inhibiting the formation of soluble or peptized iron compounds and encouraging the formation of bulky complex organic and basic ferric precipitates. These iron precipitates have adsorption properties far superior to the true ferric hydroxide floc. The higher the alkalinity, the greater is the tendency to produce hydroxide floc and consequently lowered efficiency in colloidal waters.

Because of the greater atomic weight of iron, the ferric complexes are higher in gravity than the similar aluminum complexes. The floc upon formation is very bulky but subsequently, at the bottom of the basins, shrinks markedly. The iron present is capable of combining with certain gases produced during putrefaction of organic sludges.

As to economy of coagulant—less ferric iron has been required than has been true of alum for the same result in connection with color removal. For turbidity removal the ferric salt required is less, although not as noticeably so as when dealing with color removal. The comparison is made on a pound for pound basis, employing commercial copperas ($FeSO_4:7H_2O$) which after chlorination has a 28.5 per cent Fe_2O_3 content as against ordinary filter alum containing 17 per cent Al_2O_3.

Cost Data.—Very little can be said at this early stage concerning cost of coagulation with chlorinated copperas or ferric chloride as compared with other coagulants.

At Elizabeth City the most recently available figure is $12.00 per m.g. when applying 3.25 grains per gallon of chlorinated copperas as the primary coagulant, and 0.75 grain per gallon of sodium aluminate as the secondary coagulant; this against a somewhat higher cost for alum and sodium aluminate. In addition, however, the better results from the ferric coagulant should be taken into account.

Recently figures have been secured to show the delivered cost of chlorine and copperas for producing chlorinated copperas at New York which yield the following data:

Material	Per cwt. Delivered
Sugar copperas in bags (car lots)	$0.65
Chlorine in one ton containers (15 tons per carload)	3.33

8 copperas + 1 chlorine, to produce chlorinated copperas, gives a chemical cost of $21.38 per ton of copperas chlorinated, i. e., roughly $1.07 per hundred. Employing copperas delivered in bulk cars the cost of chlorine plus copperas becomes $18.88 per ton, or $0.95 per hundred for a product having 28.7 per cent Fe_2O_3 content.

Milwaukee, Wis., is securing a 5-year supply of ferric chloride at approximately $0.95 per hundred (delivered Milwaukee) for a material containing 45 per cent $FeCl_3$, i. e., 21.6 per cent Fe_2O_3 equivalent. Approximately the same cost as that at Milwaukee will apply for ferric chloride at New York. The material is shipped as a solution in rubber lined tank cars, but the consumer pays only for the actual $FeCl_3$

content delivered, the manufacturer standing all freight charges, including that on the 55 per cent water content.

Chlorinated copperas may be produced either at Richmond or Norfolk, Va., at a chemical cost including all freight charges of:

Materials (including all freight charges)

	Cost per cwt.
Sugar copperas in 200 lb. bags (car lots)*	$0.775
Chlorine in 150 lb. cylinders (car lots)	5.75
Chlorine in one ton containers (15 containers per carload)	3.46

Employing the ratio of 1 chlorine to each 8 of copperas, the following costs per 100 lb. of copperas chlorinated result:

A: From chlorine purchased in 150 lb. cylinders:

100 lb. copperas	$0.775
12.5 lb. chlorine	0.719
	$1.494

B: From chlorine purchased in 2000 lb. containers:

100 lb. copperas	$0.775
12.5 chlorine	0.432
	$1.207

We believe that the economics involved and the proven efficacy of ferric salts as coagulants justify the consideration of the persons interested in water purification, sewage disposal and industrial wastes treatment.

* With copperas shipped in bulk, i. e., loose in the car, a reduction of $2.50 per ton for copperas is in order.

References

1. R. S. Weston, Jour. A. W. W. A., vol. 11, 1.446, 1924 Water Works, vol. 59, June 1923.
2. E. S. Hopkins, Journ. Ind. and Eng. Chem., vol. 21, p. 58, Jan. 1929.
3. G. C. Whipple, Proc. 26th Meeting of the A. W. W. A. 1906.
4. L. B. Miller, Public Health Reports, July 3, 1925. Public Health Reprint No. 1023.
5. F. W. Mohlman, J. R. Palmer, Eng. News-Rec., Jan. 26, 1928.
6. L. L. Hedgepeth, W. C. Olsen, J. A. W. W. A., vol. 20, p. 467, Oct. 1928.
7. L. L. Hedgepeth, Jour. N. Carolina W. W. A., vol. 6, p. 38, 1928.

Acknowledgment.—The above paper was presented April 26 at the First Virginia Conference on Water Purification and Sewage Treatment, Richmond, Va.

Channel Crossing Utilizes Flexible-Joint Pipe

In connection with the construction of the new West Side sewage treatment works of the Sanitary District of Chicago, it was necessary to carry a 12-in. water line across the main channel of the sanitary canal of the District. The illustration presented herewith depicts the method of making this crossing by assembling 12-ft. lengths of flexible-joint cast-iron pipe on a barge anchored across the channel and lowering the assembled line to the bottom of the canal.

Before installing the line in this manner the contractor made a test of the joints on shore. Several lengths of the pipe were joined and subjected to a pressure of 150 lb. per sq. in. with the test section in a straight line. This pressure was held while the joints were deflected 15 degrees and again brought to a straight line. No leakage being apparent, installation of the flexible-joint line was begun.

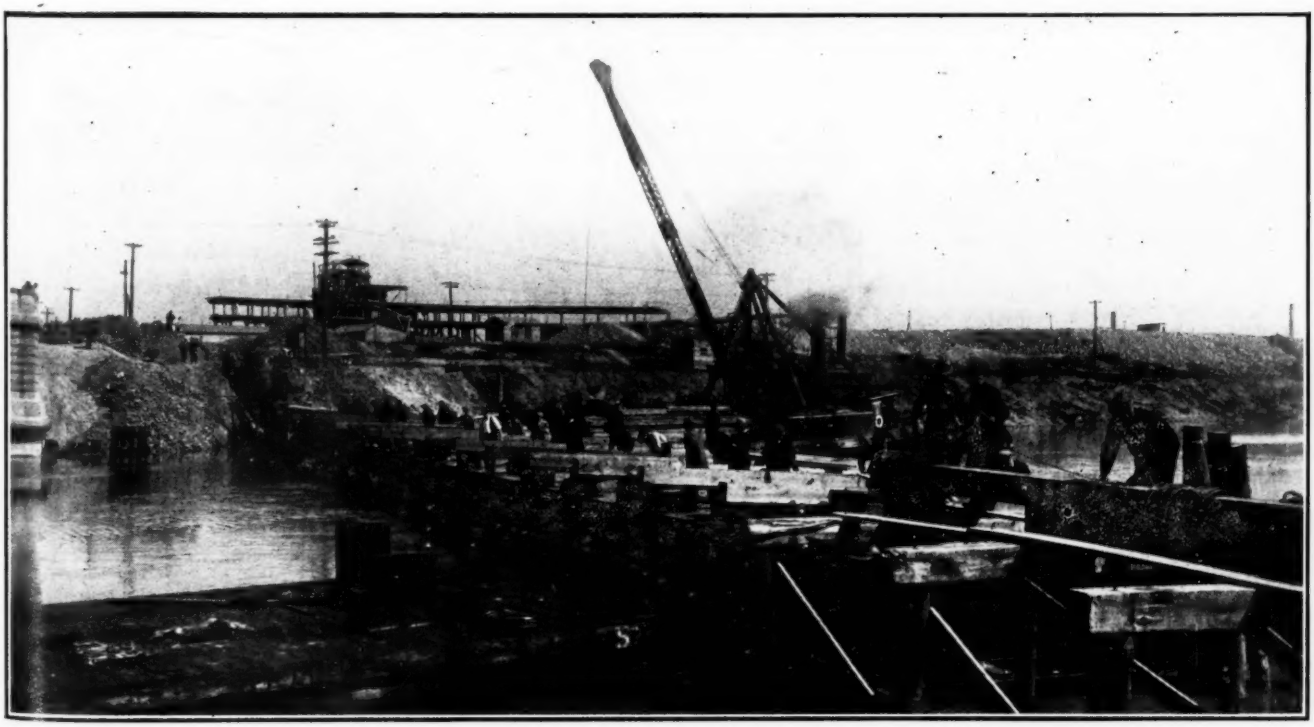
The submerged section of the crossing required 37 of the 12-ft. lengths. The joints were made up on the barge and on the shore. One end of the line was fastened at the shore-line and the other end was allowed to rest free on rollers so that the flexible string would slide down the bank and take its place at the bottom of the channel when lowered. As shown, each length of pipe was supported from the barge by a block and tackle. The lowering was carefully supervised, in order that no joint might be deflected an undue amount. Upon completion of the lowering, the free end of the flexible line was connected to the bell-and-spigot line on the shore. The completed line showed no leakage under a pressure of 150 lb. per sq. in.

By installing flexible-joint pipe in this manner, the services of a diver were not required except for inspection of the line.

FitzSimons & Connell Dredge & Dock Co. were sub-contractors for this work.

Iron Oxide for Gray Concrete

Colored concrete highways may serve as an intriguing variant of the present common white surfaces in the future. In discussing the sheet concrete pavements of Erie County, N. Y., George C. Diehl, county engineer, notes the instance of a high-grade residential development, the owners of which wished to get away from the white color of ordinary concrete. The pavement was given a slate-gray hue by including in the top-course mix 1 lb. of iron oxide per bag of cement.



Installation of 12-In. Line for the Sanitary District of Chicago. Joints Made Up and Line Suspended, Ready for Lowering

The Use of Rock Asphalt in Middletown, Conn.

Resurfacing Concrete and Macadam Pavements

By G. ALLEN SCHAEFER
Director of Public Works, Middletown, Conn.

MIDDLETOWN has done some very interesting work with rock asphalt within the last few years. The writer, therefore, felt that a brief outline of some of its operations would prove of interest.

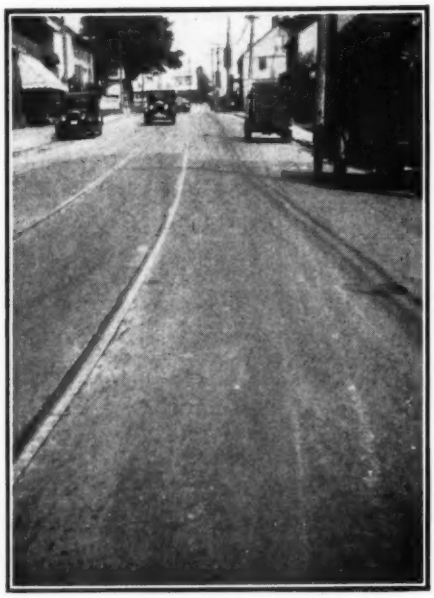
When the writer was appointed director of public works he became very much impressed with the material which his predecessor used in a limited quantity for patch work.

Resurfacing Worn Concrete Pavements.—After a very thorough investigation it was decided to use Kentucky rock asphalt for the resurfacing of Mount Vernon St. The existing pavement in the street was of cement concrete. This was very badly worn, especially along the trolley rails. In fact in many places the pavement heaved and was higher than the rails, concrete was chipped wherever such a condition existed and the entire area was then resurfaced from curb to curb featuring the Kentucky rock asphalt (Kyrock) to an edge where chipping was unnecessary.

Resurfacing Old Bituminous Macadam.—The residents along Mount Vernon St. and the officials of our city were so well pleased with the results that it was decided to continue our work with Kentucky rock asphalt during the year 1927. Washington St. was the first operation. The old bituminous macadam wearing surface was scarified wherever necessary. Two inch broken stone was added in sections where close examination proved the base to contain insufficient stone. The roadway was then reshaped and thoroughly rolled with a ten ton roller. The Kentucky rock asphalt (Kyrock) wearing course was applied in a layer 2¼ in. loose which compacted to 1½ in. Scarifying was done on that portion of Washington St. between Main and High St. The pavement between Vine and Thomas St. was not scarified. The surface was thoroughly broomed and then covered with an asphaltic paint having a penetration between 30 and 60. As soon as the paint became tackey the rock asphalt was applied as in previous operations.

Court St. from Broad St. to Valley RR. was resurfaced in a similar manner.

Disintegrated sections of the existing cement concrete pavements on Summer St. and South Main St. were resurfaced with rock asphalt the concrete surface being painted before applying the new wearing course material.



Resurfaced Concrete on Mount Vernon St., Laid in 1926. Picture Taken April, 1929

Part of Hartford Ave. which runs under the railroad bridge was also resurfaced. During the overflowing of the Connecticut River in October, 1927, approximately 3 ft. of water covered the rock asphalt surface for about two days. Although miles of pavement were ruined by the overflowing of this river the present condition of the underpass is as good as the day it was laid.

Rock Asphalt Wearing Course.—The work performed with Kentucky rock asphalt during 1927 was further proof to us that this material suited our needs, and it was therefore decided to continue the work with it. The first street to be built in 1928 was North Main St. a 6 in. compacted water bound macadam base built of 2 in. trap rock upon which was spread the Kentucky rock asphalt wearing course.

The following streets were also built in 1928 in similar manner: Johnson St. from North Main St. to Berlin Branch RR. College St. from Main St. to Broad St. Church St. from Broad St. to Hotchkiss St. Washington St. from High St. to Park Place. Berlin St. entire length.

Costs.—Approximately 2,760 sq. yd. were resurfaced by L. Suzio & Co. of Meriden, Conn., during 1927 at $1.80 per sq. yd.

In 1927 A. Brazos & Sons, Middletown, was awarded the contract. Approximately 20,000 sq. yd. were resurfaced at the following unit prices:

Scarifying 15 ct. per square yard.

Broken stone rolled in place $3.50 per ton.

Kentucky rock asphalt (Kyrock) wearing surface $1.62 per square yard.

A. Brazos & Sons were again the successful bidders in 1928. The unit prices on approximately 30,000 sq. yd. were:

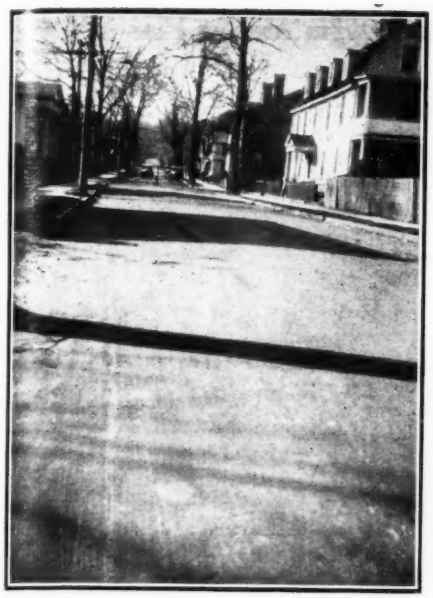
Excavation $1.15 per square yard.

Broken stone rolled in place $3.50 per ton.

Kentucky rock asphalt (Kyrock) wearing surface $1.50 per square yard.

The average cost of completed pave-

Spreading Rock Asphalt on 6 in. Macadam Base in 1928 on Church St.



View of Church St., in April, 1929

ment on work performed during 1928 was $3.00 per square yard.

The writer's close observations of the completed rock asphalt pavements proved to him that such a wearing course improves with age. There appears to be absolutely no rolling, shoving or creeping of the material. The Silica sandstone aggregate gives it the non-skid quality which in the writer's opinion is worthy of very serious consideration especially when deciding upon pavement for a street having an appreciable grade. All cracks appearing on the surface due to the opening of the base knit under traffic within a comparatively short time.

All operations were under the personal supervision of the writer as well as the engineers of the Kentucky Rock Asphalt Co. The wearing course was laid in each instance in accordance with the specifications of the Kentucky Rock Asphalt Co.

Coagulation of Highly Colored Waters

Prechlorination and Filtration at Norfolk, Va.

By WILLIAM W. WATKINS
Chief Chemist, Bureau of Water, Norfolk, Va.

ABOUT a year after taking charge of the Norfolk, Virginia, filter plant in 1922 the possibilities of using liquid chlorine to reduce the amount of alum necessary to coagulate the highly colored waters were taken up and it has proven that a material saving in dollars and cents as well as a better quality of water could be produced by the addition of liquid chlorine to the raw water.

In any discussion of Norfolk's water supply it is necessary to always keep in mind the fact that there are two supplies and that while they have the same general method of purification the differences will only be touched on in this paper.

Norfolk's Water Supply. — The Moores Bridges plant is located on the edge of Princess Anne County about six miles from the heart of the city. The water is impounded in a series of lakes connected by canals. These lakes were old salt water inlets dammed off from Chesapeake Bay and allowed to freshen up. This supply has been in use for about 50 years and at the present time furnishes about 60 per cent of the daily consumption. The filter plant was built in 1898 and revamped in 1921.

Resurfaced Old Macadam Constructed in 1927 on Washington St.

While this water will run an average color of 50 to 60 on the platinum cobalt scale it occasionally reaches the color of 160 for a few days at the time. The turbidity will average about 25 but owing to the topography and cultivation of the surrounding country it sometimes runs to 5000. The free carbon dioxide is very susceptible to seasonable changes but the alkalinity to methyl orange (30 p.p.pm.) is fairly constant throughout the year except after very heavy rainfall when it becomes necessary to add soda ash to replace the natural alkalinity of the raw water lost by dilution.

The Lake Prince Filter Plant is located on 37th Street near the Lambert Point coal piers. Lake Prince, itself, holding about 3.7 million gallons of water, is located in Nansemond County about 6 miles southwest of Suffolk. Water from Lake Prince is pumped to the filter plant through 20 miles of woodstave, concrete and cast iron pipe with crossings under the Nansemond and Elizabeth Rivers.

This water carries a higher color than Moores Bridges, averaging around 70. In the three years of its operation the turbidity has never reached as high as 50 but the color has been as high as 200 for periods of ten days. With an average alkalinity of 40 p.p.m. and a pH of 7.0 no artificial alkalinity is necessary for coagulation.

The combined capacities of the two plants is 28,000,000 gal. daily, the average consumption being about 12,500,000 gal. per day either plant is capable of carrying the load, but owing to the balancing of the pressure it is found to be more economical to run on a 7 to 5 basis, that is 7 million at Moores Bridges and 5 at Lake Prince.

The Former Treatment.—Prior to November, 1923, the general method of treatment at the Moores Bridges plant can be briefly summarized. Aluminum sulphate in the average of 2.00 grains per gallon was added to the raw water, which was allowed to settle for 4 hours, filtered through rapid sand filters, CO_2 reduced with hydrated lime, and chlorine added for sterilization. In addition, chloride of lime was added to the wash water and tons of copper sulphate were used annually to keep down algae. The average percentage of wash water was 4 to 5 per cent. The average filter runs were about 16 hours.

In the fall of 1923 experimental work was done on the use of liquid chlorine to assist in the coagulation of the water. The work was carried on experimentally for about a year after which time it was decided to make a permanent installation of the chlorine machine.

Application of Chlorine.—The chlorine was applied to the raw water in the mixing chamber about one minute ahead of the alum. It was found that best results could be obtained by adding approximately 6 pounds of chlor-

ine per million gallons of water. This would give a residual of 0.1 p.p.m. ten minutes after application or as the water passed from the mixing chamber into the coagulating basin. Higher residuals did not seem to lessen the quantity of alum used at all. Unless 0.1 residual was carried no results in reduction were obtained.

Before prechlorination or what should be more properly called split-chlorination, was tried, it required from 4 to 6 lb. of chlorine per million gallons of water for sterilization. With the split dosage it required 5 lb. for the prechlorination and 2 to 3 for sterilization. The Lake Prince plant was not operated long enough before split-chlorination was adopted to have any data on alum alone to work from. When prechlorination was tried out at that plant it was found that 7 lb. per million gallons of water gave the best results. This gives a residual of 0.2 p.p.m. 20 to 30 minutes after application. When the Lake Prince plant was put in operation a good deal of trouble was experienced with algae—asterionella being the type giving the taste and odor troubles. For reasons governed by local conditions it was not desirable to use copper sulphate so prechlorination was adopted as regular routine and has been found very effective in stopping algae taste and odors.

Results of Prechlorination.—Aside from the actual amount of alum saved it is found to be much easier to get the maximum color removal with split chlorination than with alum alone. The length of the filter runs were increased from 16 to 24 hours, and the filter beds are kept in much better condition by the use of split-chlorination.

A marked reduction in the bacterial loading was noted with the prechlorination dosage as applied. While Norfolk still adds chlorine for sterilization purposes it is done as an added precaution rather than as a necessity.

I know of no better way to give you my reasons for the continued use of a split dosage of chlorine than to quote from a report written several years ago to Mr. W. H. Taylor, Director of Public Works, Norfolk.

"I find that I can save from 0.4 to 0.6 grains per gallon of alum by the use of 6 lb. of chlorine per million gallons of water. The lower dosage of alum gives a lower free carbon dioxide content and for that reason I am able to save some lime. (The fact that the carbon dioxide content is so variable in the raw water makes it very hard to get the exact quantity of lime saved). However, to offset the saving in lime there is the increase in the amount of chlorine fed. Formerly I used 5 to 6 lb. per million gallons of filtered water but now I use about 9 lb. for the combination of prechlorination and sterilization.

Aside from the saving in alum the greatest advantage of prechlorination is in the saving of copper sulphate and wash water. Prior to prechlorination there were times when it was impossible to get filter runs of over 6 hours without the use of copper sulphate. Since I have been using chlorine the minimum average for a two-year period is a twelve-hour run, maximum being well over 20 hours. During this period no copper was used. As well as I can estimate the saving is about a dollar a day on the wash water end of it.

There is another item which cannot be put down in dollars and cents and that is the condition of the filter beds, which are in much better shape than formerly.

I am confident that the City of Norfolk is saving from $5.00 to $7.00 per day on alum, lime, and wash water, leaving the question of copper sulphate and filter beds out of the consideration.

Red Water Troubles.—In Norfolk, as in all other cities on the Atlantic Coastal Plain, which have soft colored waters we have our red water troubles. Perhaps I should say had our red water troubles, for we have cut down the number of complaints to those few who grumble for the sheer love of grumbling. We do not feel, however, that the problem is entirely solved and at the present time we are considering the use of caustic soda.

When hydrated lime was first used in 1922 only enough was used to reduce the free carbon dioxide to 5 p.p.m. or less. That helped but was not sufficient and at the present time enough lime is added to give a pH of around 8.6 to 9.0 with a phenol alkalinity of 6 to 8 p.p.m. What red water we do get is in dead ends and it is my firm belief that it is due to dissolved oxygen. I have not been able to establish this as a positive fact but everything points in that direction. In winter when the dissolved oxygen is greatest, 8 to 9 p. m., we have most of our trouble.

Acknowledgment.—The foregoing is a paper presented at the First Virginia Conference on Water Purification and Sewage Treatment.

Mosquito Extermination Scientific in Winnipeg

Mosquito extermination in Winnipeg, Canada, is carried out in a scientific manner under Mr. Eric Hearle, expert entomologist, who directed the research in the identification of the types and habits of the mosquitoes of the district, according to the annual report of the Public Parks Board of that city. Plans for continuous annual effort were mapped out.

According to the Toledo City Journal active extermination work by oil spraying was carried on within a radius of two miles of the city's center and for a like radius of the suburban parks and municipal golf courses. Large areas of shallow, stagnant water, forming ideal breeding pools, which were caused by the heavy rainfall, were sprayed, and excellent results obtained.

Ice Diaphragm Aids in Placing Concrete Under Water

An ingenious scheme used for cutting off salt water encountered in the drilling of a deep well at the new Proviso yard of the Chicago & North Western Ry. was described by G. A. Saint, assistant engineer with the North Western, in a paper presented before the Western Society of Engineers.

It was important that an adequate supply of soft water be provided for locomotives; hence as large a well as possible was sunk. A shaft 20 in. in diameter was sunk to a depth of 2,100 ft., at which level a pumping test was made. This test was judged unsatisfactory, as a flow of 250 gal. per minute was all that was obtained. It was decided to go deeper, and the well was sunk to a depth of 2,250 ft. A 1,600-ft. length was cased off to get rid of the hard water at the top. A second pumping test, made at the 2,250-ft. level yielded satisfactory results as to capacity, showing a flow of 400 gal. per minute. However, an analysis of the water showed the presence of 28 grains of salt per gallon, indicating that the water would be unfit for boiler use, and that some means of eliminating the salt would have to be found.

Since water from the 2,100-ft. level contained no salt, it was decided to fill the bottom 150 ft. of the well with concrete. This raised the problem of lowering the concrete through about 2,100 ft. of water without separating out the cement and finer aggregates. Following the suggestion of an old-time well driller, the concrete was lowered in a section of steel casing, 12 in. in diameter and about 12 ft. long. Two pins were placed across the bottom of the casing and a piece of ice about a foot thick was trimmed to rest on the pins and stop up the bottom tightly. The ice was placed in the casing, the remainder of the shell was filled with the concrete mix, and the whole was lowered to within a few feet of the bottom. The temperature of the water was about 60 deg. and the time of lowering was approximately 3 minutes. When the ice melted, the concrete ran out the bottom of the casing and filled up the hole.

Proviso yard covers an area of 1,500 acres just west of the city of Chicago, has a total track mileage of 230 miles and involves an authorization to date of $10,000,000. Completion of the project as contemplated will call for the expenditure of at least $5,000,000 more.

Protecting Exposed Pipe Lines

Pipe lines which must be carried over bridges may be protected from freezing temperatures by placing the pipe in a wooden box and filling the space about the pipe with an insulator such as sawdust or mineral wool.

Garbage Incineration at Toronto, Ont.

Operation and Costs of Disposal in 1928

DURING 1928 the destructor plants of Toronto, Ont., handled over 159,000 tons of household garbage and combustible material at a cost of $1.26 per ton. Some interesting facts on the operation of these incinerating plants is given in the 1928 report of George W. Dies, Street Commissioner of Toronto.

The Don Destructor.—The Don destructor was completed in July, 1917, at a total cost of $225,000, exclusive of land. The plant is of fire-proof construction throughout, and consists of three high-temperature four-cell furnace units, with combustion chambers, connecting flues, regenerators, and all appurtenances. The radial brick chimney is 25 ft. from the outside of the building, and is constructed with a self-supporting refractory lining, extending from the foundation to the top of the chimney, the inside of which is 90 in.

The overall height of the chimney, including the octagonal base and radial column, is 175 ft.

During 1928, 53,961 tons of refuse were disposed of at a total cost of $1.46 per ton, or 2.4 man hours of labor per ton. This total unit cost is based upon the total operating cost of the plant for the year, which includes tipping-floor man, charging men, stokers, ash-run men, removal of ash residue, supervision, weight scale clerk, privileges accorded employees, consisting of a half-day off per week with pay, all statutory holidays, two weeks' holidays, one month's sick pay, supplies and repairs to plant and building.

The plant has a guaranteed capacity of 180 tons per 24-hour day, but it destroys on an average of 200 tons per 16-hour day. The reduction by weight of the refuse delivered to the plant is 89 per cent.

The material delivered passes over a weigh-scale platform, where the weight is recorded. It is then drawn into the plant on to the tipping floor, where the vehicles are backed, and the contents dumped to the charging floor below. From that point it is charged into the containers of the furnaces by the charging men. The dumping of the containers is controlled from the stoking floor level, compressed air rams being provided for operating the furnace covers and the container doors. The refuse passes through the opening and drops upon a drying hearth inside and at the back of the furnace; it is then drawn over and spread on the grates, where incineration takes place. After the residue has accumulated to such an extent so as not to retard effective burning, large counter-balanced doors at the front of the furnace are raised, and the residue is removed from the grates, dropping by gravity through openings on the stoking floor, falling into steel side-dump cars (located in what is known as the ash run) of about one and a half cubic yards capacity. The trucks are moved over a narrow gauge track and placed upon an electrically-operated freight elevator, which raises the residue to the ash bin on the tipping floor level. On this floor a weight scale is provided, which records the weight of the residue before dumping it into an elevated ash bin. The removal of the residue is effected by means of adjustable chutes, through which it flows into any desired vehicle, at grade level. It will be noted that the system is gravity throughout, with the one exception, where the residue is raised from the ash run to the bin on the tipping floor level.

The furnaces are what is known as the continuous grate regenerative type, the cells are divided by low-set air-cooled surrounding castings which renders it possible to fire and clean the grates in an individual manner. The gases pass over the cells into the combustion and settling chamber; at the back end of this chamber a firebrick dividing arch is constructed, that splits the gases, a requisite portion of which pass into the air heater or regenerating chamber, the air heater being designed for pre-heating the forced draught. Any gases not otherwise utilized pass into the by-pass flue, through the connecting flues which are coupled to the main flue, and from thence into the chimney.

Wellington Destructor.—The Wellington destructor was placed in operation in April, 1925. The total cost of the plant amounted to $550,000, exclusive of land. The entrance to the plant is by an approach 250 ft. long and 24 ft. wide, with a 4 per cent upgrade. A 25-ton weigh scale is located on the causeway immediately in front of the entrance to the tipping floor.

The main building is 180 ft. long, and 100 ft. wide, with roof trusses spanning the entire width, and covered with a reinforced concrete roof upon which felt and gravel roofing is laid. The roof is designed with a monitor extending almost the full length of the building. The monitor is equipped with ventilating louvres. The building throughout is of fireproof construction. There are four floors at different levels. The vehicles entering the plant from the approach on the tipping floor level. The tipping floors extend nearly the full length of the building and are 35 ft. wide, connected by a bridge across the charging floor 20 ft. wide, thereby making it possible in an emergency to dump on each side of the charging floor, which is 10 ft. below the tipping floors.

This charging floor extends the full length of the building, and it is 15 ft. wide each side of the charging containers, which are located on the longitudinal center line of the building. The stoking floor as well as the main floor is 18 ft. below the charging floor level. These floors also represent the low grade level. Another floor, known as the ash-run floor, is 8 ft. below grade.

The capacity of the charging floor is such that it is possible to store sufficient material in an 8 hour delivery to operate the plant 24 hours.

The equipment of the plant consists of four 4-cell furnaces complete, with combustion chambers, air heaters, connecting flues, main flues and two radial brick chimneys, and all appurtenances, including forced draught equipment, air compressors and temperature recording instruments.

The general arrangements of the flues are such that it is possible to operate any desired battery of three furnaces together with any one chimney (each chimney being capable of operating three furnaces in battery), so that at all times the plant may be operated at not less than 75 per cent capacity.

Dual air compressors are provided so as to be capable of furnishing a constant supply of air for operating the container doors and furnace covers.

The Wellington destructor has a guaranteed capacity of 400 tons per 24 hours, but has during the summer months destroyed 350-400 tons per 16 hour day.

The opening of this plant in 1925, replaced the old Western Crematory on

Summary of Operation of Don Destructor, 1917-1928

Year	Total Labor Cost	Labor Cost and Maintenance	Tonnage Destroyed	Labor Cost per ton	Total Cost per ton
1917	$12,783	$16,053	12,699	$1.00	$1.26
1918	29,874	39,369	27,303	1.09	1.44
1919	27,397	41,060	27,811	1.02	1.47
1920	38,407	53,271	33,688	1.14	1.58
1921	54,237	66,760	47,392	1.14	1.40
1922	55,529	74,640	49,842	1.11	1.40
1923	54,292	69,098	44,673	1.21	1.54
1924	58,889	74,458	50,985	1.15	1.46
1925	63,147	75,648	50,159	1.25	1.50
1926	68,557	79,500	52,081	1.31	1.52
1927	66,462	74,539	51,089	1.30	1.46
1928	70,450	78,701	53,961	1.31	1.46

Summary of Operation of Crematory and Wellington Destructor, 1917-1928

Year	Total Labor Cost	Labor Cost and Maintenance	Tonnage Destroyed	Labor Cost per ton	Total Cost per ton
Crematory—					
1917	$14,487	$15,382	19,381	$0.75	$0.79
1918	16,387	19,926	18,615	.88	1.07
1919	20,889	25,725	20,751	1.00	1.23
1920	26,602	35,062	18,815	1.41	1.86
1921	29,589	35,184	21,680	1.36	1.62
1922	29,183	33,452	19,467	1.49	1.71
1923	33,016	35,769	26,638	1.23	1.34
1924	32,328	35,526	24,127	1.33	1.47
Wellington Destructor—					
1925	$64,966	$70,448	63,351	$1.02	$1.10
1926	72,475	79,467	69,822	1.03	1.13
1927	76,095	84,142	77,134	.98	1.09
1928	80,876	90,059	80,471	1.00	1.12

Strachan Avenue, a plant which had been in operation for over 30 years. It consisted of two furnaces, operating under natural draught, and disposed of 80 tons of refuse per 16 hour day. While the crematory was of rather antiquated design, and the building portion was in latter years beyond repair, it served its purpose well, and was no doubt a modern plant at the time of its construction.

The total labor cost includes all labor engaged in the disposal of the refuse, supervision, weigh scale clerk, and privileges accorded employees. The labor cost and maintenance includes the total labor cost, plus repairs to plant and building, supplies and equipment, which is the total operating cost of the plant for the year. The ash residue amounts to 11.2 per cent of the total tonnage destroyed.

Island Incinerator.—The Island Incinerator is situated at Centre Island. It was placed in operation in 1915 at a cost of $25,000, exclusive of land. The plant consists of one burning unit operating under natural draught, and destroys all garbage, rubbish and night soil collected upon the Islands. No fuel is used to augment the fires.

There is only one stoker engaged at this plant, and during 1928, 648 tons of material were destroyed, at a total cost of 2.3 man hours of labor per ton. The total operating cost of the plant during 1928 amounted to $952.80.

The collection and disposal services at the Island commence in the early part of May and terminate in October. The consistency of the material collected is considerably heavier than that removed in the City, and is principally composed of table refuse and night soil. The material is collected in metal receptacles and conveyed by horse and cart to designated points where the cans are transferred to a five-ton workboat, which conveys the refuse to the incinerator dock. The cans are placed upon a push truck operating upon narrow-gauge rails and moved into the building, then raised by elevator to the charging floor. The receptacles are emptied into the charging holes where the refuse falls upon the drying hearth, to be later distributed over the grates by the stoker.

The Island collection service is rendered by a foreman, two drivers and vehicles, two laborers, and a work-boat, the foreman being responsible for the operation of the boat. The service is under the supervision of the Superintendent of the Eastern Division, and during the season of 1928 was performed at a total cost of $4,988.30, which cost is included in the general summary of the refuse collection service.

The total labor cost includes all labor engaged in the disposal of the refuse. Labor cost and maintenance of plant and building, supplies and equipment, which is the total operating cost of the plant for the year. The ash residue amounts to approximately ten per cent.

Summary of Operation of Island Incinerator, 1921-1928

Year	Total Labor Cost	Labor Cost and Maintenance	Tonnage Destroyed	Labor Cost per ton	Total Cost per ton
1921	$576	$ 697	668	$0.87	$1.00
1922	662	755	744	.88	1.01
1923	633	1,200	671	.94	1.79
1924	729	994	716	1.02	1.31
1925	763	966	701	1.08	1.41
1926	720	1,024	656	1.15	1.56
1927	758	978	663	1.14	1.48
1928	690	952	684	1.02	1.39

Flushing in Backfilling

The problem of backfilling trenches in such a manner that the maximum amount of dirt excavated will be replaced and the fill thoroughly settled is one which confronts contractors in sewer and water-supply work. It will generally be found that flushing the trench produces better results than hand tamping if the puddling operation is performed properly and if the soil is not clayey.

To secure the most complete settlement, fill the ditch with dirt, piling the excess over the fill, and flush the trench from the bottom. A pipe may be attached to the end of the hose and pushed through the dirt until it strikes the sewer or water main. The water should be allowed to flow until it reaches the top of the trench. This operation is repeated at intervals along the pipe line, the length of intervals depending upon the nature of the soil and the size of the trench. Flushing should never be done from above, as the puddled earth is likely to lodge part way down the ditch, preventing proper settlement of the bottom of the fill. Contractors who have relied upon hand tamping may be surprised to find the judicious use of water producing a settlement of 1 or 2 in. in an ordinary hand-tamped fill.

In sewer work, there is danger from the collapse of manholes during backfilling. If the flushing method has been used, the collapse of a manhole may introduce water into the sewer, resulting in damage to the work or injury to the workmen. Care should be taken to maintain a uniform pressure on all sides of the manhole during backfilling.

Sanitary Engineering Courses

The data concerning sanitary engineering courses in colleges in the United States, prepared in 1924 by Isador W. Mendelsohn, Associate Sanitary Engineer, U. S. Public Health Service, has now been brought up to 1928. The data for the later year are given by Mr. Mendelsohn in a comprehensive article in the March 22 issue of Public Health Reports. He summarizes his findings as follows:

1. There are 16 colleges in every section of the United States at present offering either regular or optional courses in sanitary engineering.

2. There is considerable difference of opinion among the universities as to the fundamental concept of a sanitary engineering course.

3. The sanitary engineering courses are in reality civil engineering courses with certain appended subjects, such as water supply, sewage disposal, the bacteriology and chemistry of water and sewage, and a little public health.

4. Emphasis in both sanitary engineering and public-health subjects reflects in practically all the institutions the personality of the professor of sanitary engineering.

5. The number of sanitary engineering graduates annually is increasing.

6. There is a great variation in the degrees granted by the institutions for equivalent work and also in the names of the course.

7. In 4 of the 16 institutions the term of sanitary engineering course is either five or six years.

Municipal Reference Libraries.—The 15 cities of the United States that have municipal reference libraries are: Baltimore, Chicago, Cincinnati, Cleveland, Detroit, Los Angeles, Milwaukee, Minneapolis, New York, Philadelphia, Portland, Ore.; Rochester, St. Louis, Seattle and Toledo.

Recording Operating Data on Filtration

Keeping Books on the Filter Plant

By WELLINGTON DONALDSON

Of Fuller & McClintock, Consulting Engineers, New York City

IN the furnishing of drinking water to a community, the water plant operator occupies a position of very high trust in safeguarding water consumers from water-borne disease, in addition to his obvious responsibility for providing a water of acceptable physical qualities. The possible consequences from improper operation of water purification works are too serious to permit such works to be run in a loose unsystematic manner without adequate records of their performance.

Value of Plant Records.—Aside from the value of plant records in fixing responsibility they have a very definite value to the operator in allowing comparison to be made of results from day to day, month to month, etc., of his own plant and of other plants as well. By such comparison much can be done in smoothing out operation and promoting plant economies.

Adequate records of plant operation comprise the following:

(a) Primary records of quantities, water quality and such details as are useful in controlling the plant.

(b) Summaries of the essential information contained in the primary records.

(c) Reports to department head or responsible supervising authority at stated intervals.

Primary Records.—What primary records should be made? Naturally this depends a great deal on the size of the water plant, the quality of the supply, the nature of treatment and the character of operating personnel. Take for example the typical rapid sand filter for a surface supply. The minimum records that could be recommended are as follows:

(a) Amount water treated, thousand gallons.

(b) Chemicals used in treatment, lbs.

(c) Number filters in service.

(d) Number filters washed.

(e) Amount of wash water, thousand gallons.

(f) Average filter runs between washings, hours.

(g) Turbidity of raw and delivered water.

(h) Color of raw and delivered water.

(i) Residual chlorine of delivered water.

(j) Bacterial tests for B. coli and total bacteria.

Some amplification of this minimum schedule will be called for to meet local conditions. For instance, where the filtered water is pumped, the water elevation of the reservoir, the duration of pumping and power required are pertinent items. Tests for alkalinity or pH are sometimes necessary for intelligent coagulation control.

To be useful for ready comparison the chemicals used should be shown on the unit basis (pounds per million gallons, or grains per gallon), and the wash water as per cent of treated, in addition to total amounts.

The cost of operation is not included in the above list because this information although of considerable importance is seldom available to the plant operator. He can easily however show the chemical cost per million gallons, each day.

The Most Important Item.—Of the items listed above, without doubt the last or bacterial test is the most important, for assurance of the hygienic quality takes precedence over any other kind of record. In the smaller filter plant, however, the bacterial tests are made by some laboratory not connected with the water department. Very fortunately the small plant operator without any knowledge of bacteriology may have assurance of getting good bacterial results from his plants by means of the simple test for residual chlorine, which any filter operator can make.

Means for obtaining the amount of water treated is sometimes lacking, where centrifugal pumps are installed, and where the cost of a Venturi or some other type of flow meter was not felt to be justified.

Recording the Chemicals.—It is a comparatively simple matter to keep track of the chemicals used each day, but experience shows that frequent mistakes are made in recording this item. In theory each pound of chemical applied to the water should pass over the scales, so to speak. Alum, hydrated lime and soda, however, are available in containers of sufficiently standard weight to be relied upon, but where these original sacks or barrels are broken, to make up charges, scales are necessary to keep track of the actual amount of chemical fed into the water. The weight of chlorine cylinders should invariably be gotten from platform scales, devoted to that purpose alone. When solution tanks are used for alum, mistakes are frequently made in reporting the total pounds per day due to changes in the tank charges or carelessness in filling to a fixed mark. With dry feed machines, errors in reporting are common, due to depending on calibration of the dry feed machines and where no check is made by scale weight of the alum going into the hoppers.

In case of special purification plants such as iron removal, softening, and slow sand filters, the essential data to be reported must of course be adapted to the particular plant and will differ from the essential items given above for the surface water supply.

Manner of Keeping Data.—The manner in which the essential data of operation are kept depends upon the size of the plant, the operating personnel and the quality of the water supply. Where the filter plant operator is the general factotum of the water works and attends to pumping and repairing the mains, and possibly to the collection of water rents, perhaps there is nothing better than a substantial book ruled to suit the data to be recorded say on the basis of a daily entry. With larger plants printed log sheets are desirable either on a daily or weekly basis. The log sheet is particularly desirable where there is more than one operator in order to definitely fix responsibility for happenings on the shifts.

The frequency of taking and recording readings of meters, gages, chlorinators, chemical feeds, etc., should be adjusted on a common sense basis to the local conditions. In larger filtration plants it is customary to use log sheets providing for readings each hour or sometimes at two or four hour intervals. That this matter can be overdone is shown very well by the example of one city of about 50,000 people, within the speaker's observation, where the filter attendants on 8-hour shifts are kept dressed in natty monogrammed uniforms and required not only to record numerous observations each half hour, but to plot curves. They complained very properly that they were kept so busy making records that they had no time left to run the plant.

Summarizing the Records.—Next in importance to keeping good records is the summarizing of these records into condensed form where they may be easily referred to. It is a common fault of many water plants and other business enterprises as well that much valuable detailed information becomes unavailable from lack of suitable summaries systematically carried forward. As a general proposition a summary by months is the most convenient way of keeping the operating data in shape

for ready use. Printed forms are most suitable for this purpose.

It is seldom that the filter operator is given complete discretion in all matters relating to his plant. He usually has to make a report to somebody to show what is going on at his plant. The form of report is determined by the local organizations and the ideas of the executive or official in charge. Large water departments generally insist on a daily report of operations. A weekly report is preferred by many of the utility companies which operate a number of properties. A few of the state boards of health also require a weekly report of filter plant operation. The State Board of Health in this state and in a number of other states require monthly reports of operation.

A rather unusual situation came to the speaker's attention some years ago where a city of about 50,000 population had a fine new filter plant with a competent chemist in charge. He had suitable record and report forms printed to show his operation, but when his first reports went to the City Hall, he was called on the carpet and instructed by the newly appointed water commissioner to desist from sending in any reports of this kind because he didn't want them and didn't know what they meant anyhow. Happily such conditions are rare.

Recording Operating Data Not Difficult.—The recording of operating data and the making out of reports appears to be quite a task for some operators who have not been fortunate enough to secure a good education. The speaker recalls one instance where he labored with the pumping station engineer to get him to figure his chlorine dose each day. More than once the old man threw down his pencil in disgust with the exclamation that he "was hired to run the pumps and not to figger." Patience finally won, however.

The filter plant operator who happens to be lacking in good education or technical training can take comfort from the writer's assurance, based on many years of filter plant supervision, that the best records are not necessarily made out in the best handwriting nor couched in the most grammatical language. One of the most poorly operated filter plants that he recalls was in charge of a Ph.D. while one of the best cared-for filter plants was in charge of an unlettered fellow to whom a decimal point will always remain a mystery. His records were naturally crude and hard to decipher but they served their purpose admirably. He knew what was needed to be done to keep his plant in first-class condition and he did it. The main thing about him was his mental honesty and his thorough dependability, without which qualities plant records mean very little.

Acknowledgment.—The above is a paper presented at the First Virginia Conference on Water Purification held at Richmond, Va., April 25 and 26.

Inventory of Water Supply of Pomperaug Basin

For many years the Geological Survey of the United States Department of the Interior has been actively engaged in measuring the flow of the rivers and creeks of the country and in determining the quantities of surface water that percolate down to the water-bearing rocks and can be recovered through artesian wells or by pumping. At the same time the Department of Agriculture has endeavored, by elaborate investigations, to determine the amount of water that seeps into the soil, how much of it is consumed by vegetation, and what becomes of the rest. In a Geological Survey report just published (Water-Supply Paper 597-B), by O. E. Meinzer and Norah D. Stearns, an attempt is made to present, for a period of three years, a monthly and yearly inventory of the water supply of the Pomperaug Basin, a more or less typical drainage basin in Connecticut. This paper was prepared in cooperation with the Connecticut State Geological and Natural History Survey.

The problem of the circulation and storage of the water derived from the rain and snow that fall on the Pomperaug Basin is analyzed comprehensively in this report. A part of this water is intercepted by trees and other vegetation, from which it evaporates and is returned to the atmosphere without reaching the ground; a part is evaporated directly from the surface of the ground; a part flows directly into the streams and ponds and runs off, except a small amount that is lost by evaporation; a part percolates into the ground and becomes soil moisture, or penetrates to the water table, where it enters the zone of saturation and is called ground water. The soil moisture may be absorbed and transpired by plants or may be evaporated directly from the soil. The water in the zone of saturation may be transpired by plants or may evaporate where it comes near the surface, or it may seep into the ponds and streams eventually and be carried out of the basin by the Pomperaug River.

It is believed that practically no water is lost by deep percolation out of the Pomperaug drainage basin and that practically no water enters the basin from deep-seated sources. Therefore except as there is increase or decrease in surface or subsurface storage within a given period the difference between the amount of precipitation in the basin during the period and the amount of stream flow out of the basin is approximately the amount that is evaporated directly or through the agency of plants.

Natural Storage for the Water Supply.—The water that falls as rain or snow may be stored on the surface or below the surface. Surface storage includes the water that is held in the ponds and reservoirs, and for the purposes of this investigation it includes also the water in the streams. Moreover, surface storage includes the considerable quantities of water that accumulate on the surface in winter as ice or snow. The subsurface storage consists of the soil moisture, in the zone of aeration, and of the ground water, in the zone of saturation. The storage creates an interval of variable duration between the falling of the water as rain or snow and its exit from the basin by evaporation or as run-off, and it thereby greatly complicates the problem of determining what ultimately becomes of the water that falls as rain or snow.

Estimates of Run-off, Evaporation, and Underground Percolation.—The data obtained in this investigation indicate that during the three-year period the average yearly precipitation in the form of rain or snow, stated as depth of water over the drainage basin, was 44.48 in., of which 20.66 in. was carried out of the basin by the Pomperaug River, about 23.20 in. was returned to the atmosphere by the invisible processes of evaporation from soil and surface objects and of transpiration by plants, and a small balance remained in subterranean storage. It was estimated that 11.90 in. of the yearly precipitation was carried away by the Pomperaug River without ever getting into the ground, 16.99 in. was taken back into the atmosphere by evaporation and transpiration, without having percolated down to the water table, and 15.58 in. found its way to the water table and was for an indefinite period placed in subterranean storage in the zone of saturation.

Recharge and Discharge of the Subterranean Reservoir.—At the beginning of the investigation the water table was abnormally low, and hence the subterranean reservoir was not quite filled to capacity. Consequently there was a small increase in ground-water storage during the three-year period, and the average yearly discharge from the zone of saturation was slightly less than the average yearly recharge. It was estimated that an average of 8.76 in. of ground water was discharged each year by overflow of the subterranean reservoir through springs and seeps and that an average of 6.21 in. was withdrawn from the zone of saturation by the roots of plants or through the capillary pull of the dry soil and subsequent evaporation.

Mosquito Control Operations in the Chicago District

Work of Des Plaines Valley Mosquito Abatement District in 1928

The Des Plaines district includes an area of 76½ square miles and has a population of 200,000 people. Its topography, for the most part, is flat with some hilly sections. There are two polluted streams, the Des Plaines River and Salt Creek which flow through the district. In addition there are a great many small creeks, wet weather streams, woodland pools, and cat-tail swamps.

For control work the district is divided into two sections, each section being placed under the direction of a foreman with a gang of 12 laborers and one truck driver.

During the first two months of the season these gangs engaged in the drainage and clearing of mosquito breeding areas, and later, as breeding developed, were put to work oiling the marshes. In the fall when the breeding season was over the gangs again returned to drainage work.

Section Equipment.—Each section is equipped with one ¼-ton truck, used to haul men and tools. During wet weather these trucks are rigged with barrel pumps and used to spray road ditches. During the first heavy breeding two one-ton trucks were hired to haul oil to points of distribution.

Personnel.—The district employes one sanitary engineer in charge, one assistant sanitary engineer in charge of field operations, one laboratory man in charge of the laboratory, one stenographer-bookkeeper, one river inspector, one motorcycle operator, seven house-to-house inspectors, 4 field inspectors, 2 foremen, 3 truck drivers, 1 chief inspector, 24 to 36 laborers.

The report of the district for 1928 has been issued recently and from it we have extracted the notes that follow:

Mosquito Breeding Areas.—"Consideration of permanent improvements such as will eliminate mosquito breeding areas, leads us to inquire as to what constitutes mosquito breeding areas.

"It is common knowledge that mosquitoes must have water in which to breed, but even so, not all water surfaces are inviting to mosquitoes for breeding purposes and even that portion which is chosen is given to the production of only one or several species at the time.

"The most troublesome species of the domestic group flourish in dry season when rivers and streams become polluted; woodland mosquitoes prefer the comparatively clear woodland water of woodland pools, while the predominating species of the marsh group prefer the shallow warm waters of prairie marshes and field pools. Thus it is evident that temperature and food supply of the water may control the type of breeding or change it from domestic in dry weather to marsh in wet weather, even in the same river, stream, pool or marsh. Hard rains may flush an embryonic crop of domestic mosquitoes down stream, and at the same time flood contiguous bottom lands, and hatch millions of dormant eggs of a different species.

"The percentage of the total water surface constituting potential breeding areas, varies in direct proportion to the extent of its grassy covering and the shallowness of the water. In prairies, 85 per cent of all water surfaces may be considered potential areas, whereas in the deeper and fast moving water of the rivers and streams only 40 per cent of the water surface may be considered potential breeding areas."

In the Des Plaines district the total potential breeding area in rivers, streams and prairies at the beginning of the season of 1928 was 514 acres with normal rainfall. "Approximately 75 per cent of this acreage can be eliminated by drainage and from diking and filling at an **estimated cost of** $138,233." The area remaining at the completion of such a program would be 90 acres at normal rainfall, which would be increased to 243 acres with excessive rainfall.

"Comparison of the actual acreage oiled during 1928, with that necessary to be oiled after completion of the proposed program, would indicate that mosquito production can be controlled following excessive rainfall as the acreage necessary to be oiled would be a limited amount of river and stream edges in dry weather, and a reasonable amount of field pools, wet roads and edges of overflowed areas of all rivers and streams."

Policy.—"If the total revenue of the district ($60,000 annually) were devoted solely to drainage work, it would require at least four years to accomplish the desired end. In this event annoyance from the marsh and woodland groups would be reduced each year but practically no reduction could be made in the numbers of domestic mosquitoes. On the other hand if 10 to 20 per cent of the annual revenue were set aside for permanent improvements, a well rounded program could be carried out during which time annoyance from domestic mosquitoes could be abated and only during exceptionally wet spells would the marsh mosquitoes be a menace to comfort and then only out-of-doors.

Oiling Program.—"The experience of attempting to control marsh mosquitoes (Aedes vexans) by oiling, following excessive rainfall indicates the need for eliminating large marshes, woodland pools in the prairie sections and the channeling of streams to prevent flooding of bottom lands, as the eggs of this species lie dormant from the Summer of one year until the warm rainfall of the following year. **Elimination of the large breeding areas will make it possible to organize an oiling force which can cope with the problem of lots and road ditches and wet weather prairie pools and at the same time be large enough to control mosquitoes of the domestic group during dry weather and following normal rainfall.**

"Furthermore, it indicates that in order to meet a peak load, either a large force, trained in the use of knapsack sprayers, or a comparatively smaller force trained in the use of power sprayers, must be maintained ready for the emergency."

During 1928 a total of 1717 acres were oiled at a total cost of $12,673.81. The average time required to oil an acre for the season was 8.6 hours. The average number of gallons of oil used per acre for the season was 34 gal. The average cost per acre for the season was $7.40.

Inspection of Premises.—"House-to-house inspection for the purpose of eradicating domestic mosquitoes ranks next in importance to control of breeding in polluted rivers, streams and marshes. Mosquitoes of this type enter houses, although only a very few may cause great annoyance. It follows, therefore, that if breeding is permitted to continue unabated, mosquitoes dispersing from these small areas on one or several premises in each block may destroy the morale of the whole undertaking."

Street Catch Basins.—The street catch basin is a recognized source of mosquito breeding. It produces mosquitoes of the domestic group.

The number of mosquitoes bred in catch basins over a limited area never exceeds the number produced in polluted rivers, streams or large marshes. On the other hand the number bred in catch basins often exceeds the number bred in artificial containers on home premises. However, in the catch basin, breeding is more or less constant, while home premise breeding varies both as to neighborhood and number of po-

tential breeding places present at any one time.

The control of catch basin breeding is very necessary in that production here may be the principal source of annoyance especially in the high class residential districts from which the District receives its best co-operation. There are 20,000 catch basins in the 30 square miles of built-up area in the district. The cost per treatment with oil or mosquito repellent for the season averaged 2½ cents per catch basin.

Nineteen different species of mosquitoes were caught in the district during 1928; however, only 4 different species made up 98 per cent of the total number caught. Eighty per cent were "Aedes vexans, 12 per cent Culex salinarius, 4½ per cent Aedes trivittatus and 1.2 per cent Culex pipiens." The two varieties of Aedes making up 84½ per cent of the total are marsh mosquitoes, while the two varieties of Culex making up 13.2 per cent are domestic mosquitoes which breed in polluted water.

During 1928 $53,455 were spent in permanent improvements such as drainage operations, while $53,073 were spent in operating cost.

Remedying Troublesome Conditions in Filter

Method of Removing Hard Spots, Cracks and Mud Balls

By R. W. FITZGERALD
Superintendent Water Purification, Alexandria, Va.

IN THE water purification process much depends upon the efficient operation of the filter beds. Many difficulties are encountered but probably the most common ones are hard spots, cracks and mud-balls.

Causes of Troubles.—There are many agencies which contribute to the formation of these troublesome conditions. Improper coagulation causes the water to enter the filter unit with insufficient "floc" to form a good filter mat. This allows the fine particles of silt and mud to penetrate deeply into the sand bed. Insufficient sedimentation causes the filter to receive an over-load of turbidity and bacteria. In all probability bacterial growths in the filter help in the formation of hard spots. The same is no doubt true of algae growths. Broken or clogged strainers and underdrains serve as hindrances to proper washing of the filter. Washing filters at low velocities and for short periods of time encourages the formation of mud-balls. Cracks and fissures in the filter bed are usually caused either by improper washing or by the growth of certain bacteria which cause the filter mat to contract and break.

Effect of Hard Spots.—The effect of both hard spots and mud-balls is, first, to decrease the time of service of the unit in as much as they decrease the filtering area. Secondly, they form a hazard to the quality of the effluent in that they may serve as breeding places for bacteria or by forcing the water to pass too rapidly through the remaining parts of the filter. Cracks or fissures on the other hand let the water through the filter more rapidly but in so doing they lower the efficiency of the unit by allowing turbidity and bacteria to pass through also.

Results from Combination of Treatment.—Unfortunately there is no one remedy for these troubles. Rather, the filter plant operator must use a combination of treatments to get the desired results. The best treatment, of course, is the preventative treatment. The "floc" should be of good size in order to entrap the fine particles of silt, mud, etc. The retention time in the sedimentation basins should be sufficient to settle out a very large percentage of the suspended matrial. This, of course, will mean a very substantial reduction of the load upon the filter. Where a high bacterial load is present or where algae are found troublesome prechlorination has been found to be of considerable advantage. A good example of this is shown in the operation of the water plant at Raleigh, N. C. There hard spots and cracks in the filter mat were to a great extent eliminated by the use of prechlorination. Also at Southern Pines, N. C., the average filter service hours were nearly trebled by using chlorine in the raw water. Prechlorination has been used at Springfield, Ill., to lighten the bacterial load on the filters but no particular study was made as to the effect upon the prevention of mud-balls or hard spots. A high velocity wash is one of the best methods of keeping the filter in good condition. Some years ago considerable trouble with mud-balls was experienced at the plant at Gatun, Canal Zone. The rate of flow of the wash water was 12 in. vertical rise per minute. This rate was gradually increased until 24 in. rise per minute was attained. This increase in wash water velocity practically eliminated the mud-ball trouble. The same experience was had at Colon, Canal Zone. There the rise was changed from 18 in. per minute to 24 in. per minute, with results similar to those obtained at Gatun.

Method of Removing Hard Spots and Mud-Balls. — The most successful method of removal of hard spots is to break up the area with a pole and to give the filter long hard washes. The removal of mud-balls may be accomplished in various ways. If the filter can be put out of service and allowed to thoroughly dry out the balls wil disintegrate and can easily be washe out. This method has been used a Oklahoma City when conditions per mitted. The procedure is not applicabl in most instances, however, due to th inability to leave the unit out of serv ice for any great length of time. Th method of removing the mud-balls by skimming them out with a long handled screen passed through the suspended sand during the wash has proven fairly satisfactory. This is the method in practice at Hannibal, Mo., and it has been used at Alexandria, Va., with considerable success. Scraping off the top layers of sand is common practice in many plants. Such practice has been highly satisfactory at Springfield, Ill. There the filters are all scraped at regular intervals. During the past several months very little trouble has been experienced from mud-balls or hard spots. This method, of course, necessitates periodic replacement of the sand removed. Another method which has been used at both Springfield, Ill., and Oklahoma City, is that of jetting the sand from one filter to another and screening out the mud-balls as it enters the second filter. This was accomplished by constructing a small wooden box into one side of which was set a 4 in. pipe leading to an adjacent filter. Directly opposite this pipe was set a fire hose carrying an inch and a quarter nozzle. The nozzle was placed about 5 in. from the pipe mouth and headed directly into it. The water being turned into the hose, sand was shoveled into the box and was carried by the water through the pipe. At the exit end of the pipe was placed a screen to catch the balls. This process was repeated in each filter unit and thus from 12 to 15 in. of sand was removed, washed and returned to the filter. This is rather a long process and is not recommended for use unless other methods fail to clean the filter.

Summary.—The chief causes of hard spots, cracks and mud-balls are: improper coagulation, insufficient sedimentation, bacterial and algae growths, and washes at low velocities and for too short periods of time.

The effects are to lower the quality of the effluent, to decrease length of filter runs, and to increase the number of washes.

Preventative treatments are: thorough coagulation and sedimentation, prechlorination, and high velocity washes. Curative treatments are: scraping, skimming, or removing and washing the sand.

Acknowledgment. — The foregoing paper was presented at the First Virginia Conference on Water Purification and Sewage Treatment, held April 25 and 26 at Richmond, Va.

Reducing Corrosion

How Staunton, Va., Treats Its New Supply

By W. F. DAY
City Manager, Staunton, Va.

FOR many years, Staunton, Va., obtained its domestic water supply from limestone springs located within the city limits. The water from this source is very hard (about 275 parts per million) and because of the possibility of pollution and of the deficient quantity of dependable flow, it was decided to seek a new source.

North River was selected as the new supply, as it provided a sufficient quantity for the estimated future consumption of the city, with little likelihood of pollution and is of a very soft quality.

The New Supply.—The location of the 125 million gallon storage dam and works in North River is about 15 miles northwest of the city, in the National Forest, the water being brought to the city through a 16 in. cast iron main, part of which is laid in a 6 ft. by 6 ft. tunnel through rock for 5700 ft.

A distribution reservoir of 3,750,000 gal. capacity, with aerators, was built two miles west of the city.

The cost of the new supply was over $800,000, and it was placed in operation in August, 1926.

About a year later we began to receive complaints of red water and iron rust particles being carried by both hot and cold water pipes into dwellings.

Sections of services and mains which were taken up for repairs showed a complete disappearance of the former carbonate lining caused by the hard water, and in its place was noticed the formation of tuberculation of the iron wherever the original protective coating or galvanizing was defective.

Treatment with Caustic Soda.—Following investigations and analyses of the water, with the cooperation and assistance of the State Board of Health, it was decided to raise the alkalinity of the water by adding sodium hydrate or caustic soda.

In January, 1928, we commenced feeding 60 lb. per day to 1,200,000 gal. of water. As it was some time, a week or more, before we could get any indication of the treatment in town, the amount was increased to 90 pounds per day.

We finally settled on 60 lb. per day, and tests taken twice daily at North River showed a pH of 6.6 to 7.2 of the raw water and 8.8 to 9.4 for the treated water. This produced a pH in the city of from 7.8 to 8.4.

The complaints became less frequent, and the cold water pipes delivered clear water, unless the circulation in the mains was very poor, and allowed the water to remain standing for some time in the pipe. The hot water still gives trouble; depending on the temperature to which it is heated, and also upon the condition of the boiler or heater; fixtures that are old or of poor quality offer less resistance to the corrosive action of the water.

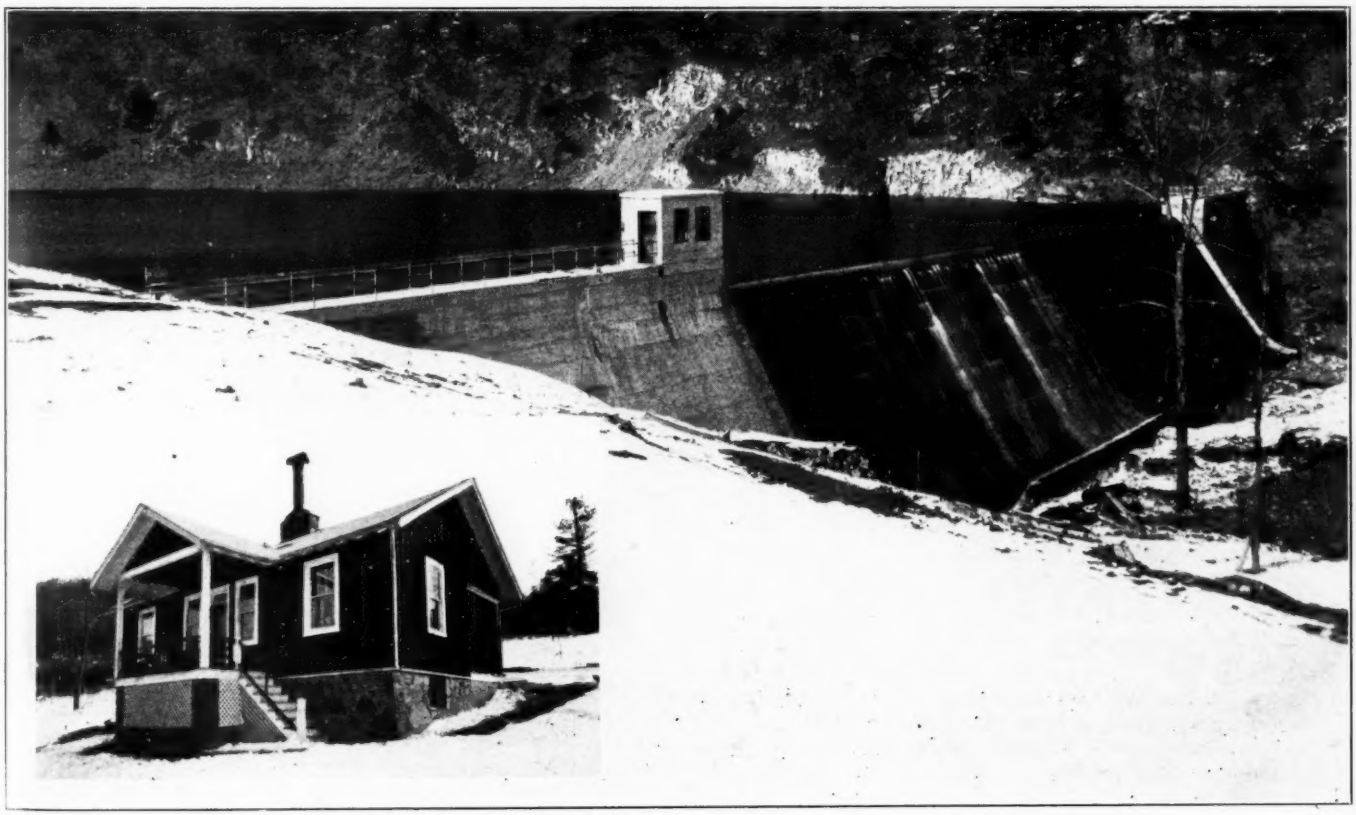
The difficulty next appeared of stoppages in the services and house pipes, caused by the tuberculation restricting the flow of water. This was particularly noticed on the hills where the pressure is lower and in ½ in. pipes of inferior material that have been installed a long time.

In October, 1928, a firm of consulting engineers in Baltimore was employed to investigate the corrosion problem and recommended proper steps to reduce the trouble.

The New Treatment Plant.—The report was received in December, and recommended the construction of a treatment plant to be built at the North River works, in order to protect the supply main to the city. At this plant the water might be treated with lime, caustic soda or sodium silicate, or a combination of them, as proved most beneficial.

The plant is to consist of a concrete building 20 by 30 ft. and a double sedimentation tank 34 by 53 ft. and 11 ft. deep, all designed for the ultimate flow of 2½ m.g.d.

In the building are to be placed a solution tank, 9 ft. in diameter, an automatic feeding device, a mixing channel and storage space for chemicals. An overshot water wheel operates the agitators in the solution tank. Head for operating the water wheel is to be obtained from water behind the dam. Tail water from the wheel flows into the mixing channel



Dam on North River and Part of Reservoir, Staunton, Va.

and thus would not be wasted. This plant is estimated to cost $14,000.

Plant Operation.—The plant is being built about 100 feet from the dam, and will operate as follows: a valve in the supply main will divert the water through a mixing channel in the chemical house, where a pre-determined amount of lime solution will be thoroughly mixed with the water.

The dosed water then flows quietly through a sedimentation basin of an hour's capacity, during which time inert chemicals and sludge settle out, the clear water in the meantime flowing continuously to the city. The water wheel is used to stir the lime or other solution in the solution tank, so that uniform strength of chemical is maintained.

The sedimentation tank is divided so that in cleaning it would not be entirely out of operation. This tank is covered with a concrete roof to prevent freezing or the admission of leaves and other trash.

Once a day the caretaker at the dam will put a weighed amount of chemical into the solution tank, filling it up with water and then inspecting the working parts, such as the water wheel, automatic measuring device, etc.

Removing Corrosion from Service.—This treatment plant is intended to reduce the future corrosion of the distribution system and house pipes, but will not remove the corrosion and stoppage of the services now existing.

This is another problem. We have been experimenting with several methods of doing this, and we have found that a 10 per cent solution of sulphuric acid, if left in a corroded service line for 4 or 5 hours, will loosen the tuberculation and by blowing compressed air through the line it will be fairly well cleared. Care has to be taken not to leave the acid in the pipe too long, for not only will the corrosion be loosened, but holes will be eaten in the pipe as well. Of course we are careful to neutralize the acid left in the line before turning the water back in the house.

We recently have tried with good results the removal of the corrosion by introducing dry steam into the service line, and as the pipe expands faster than the corrosion attached to it, the corrosion is loosened and may be washed from the line.

The treatment plant at North River is being built by city forces, and we expect to have it completed and in operation by August 1st.

Acknowledgment.—The foregoing is a paper presented April 26 at the First Virginia Conference on Water Purification and Sewage Treatment.

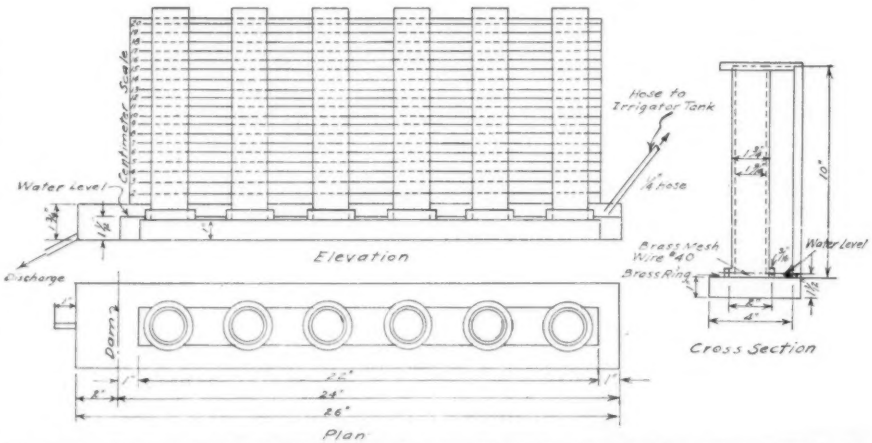
Traffic Engineers.—Twelve cities and one county now have traffic engineers.

Method of Testing Soil for Westfield Dam

Soil tests in connection with the construction of the Granville earth dam for the city of Westfield, Mass., were facilitated by the use, in the field office, of a device for measuring the capillary rise of water in the samples of soil. The method involving the use of this device was worked out by Dr. Charles Terzaghi of Massachusetts Institute of Technology.

The device, which is illustrated in the accompanying drawing, consists of a small tank to hold water and support a set of capillary tubes, an irrigator tank and a set of tubes. In making a test, the sample of earth is first dried, care being taken not to burn the material. The tubes are filled with the dry material in layers and compacted. They are then set into the tank and water from the irrigator tank is fed to the tank containing the tubes. The dam at the end of the tank holds the water to a level which will keep the bottom of the tubes always submerged. The tubes are graduated, or a scale is erected in back of them. The time is taken when the tubes are first set in the water and, as the water rises in the soil, readings are taken every five minutes. These readings are plotted on a diagram which gives the relation of the capillary rise of water in the soil to the coefficient of permeability.

Numerous tests were conducted previous to construction. The weight and volume of each sample tested are measured. Knowing the specific gravity of the material, the volume of voids and the void ratio are readily computed. While the theory underlying the process is rather involved, the application of it is very simple. Taking a set of samples, testing and recording the results requires the time of only one man about one-quarter of a day. The suitability of a material for use in the fill can be determined within an hour.



Apparatus Used on the Westfield Dam Project for Measuring the Capillary Rise of Water in Samples of Soil

Automatic Device Prevents Freezing in Pipes

A device to prevent the freezing of water in pipes, not dependent upon thermostatic action, has been exhibited recently. A brass freezing chamber is employed to spread the stream of water into a thin sheet which is frozen at a temperature 10 degrees higher than that which would congeal the water in the pipes. In freezing, the thin sheet of ice exerts pressure against a metal diaphragm which opens a drain valve and empties the pipes of water. With the advent of milder temperatures, thawing of the ice releases pressure on the diaphragm, closes the drain valve, and permits water to flow again.

Sawdust Streets Built in Lumbering Town

When the citizens of Dorris, Calif., a lumbering town in Siskiyou County, demanded relief from the muddy condition of the streets, sawdust was suggested as a paving material. Several tons were secured from nearby sawmills and distributed over the streets of the town. After the sawdust had packed down, it was found to give an excellent roadway surface.

Recording Meter Readings by Photography

Where tests are being run which require frequent readings of a number of instruments, or where simultaneous readings of a number of meters, etc., are required for purposes of record, it will be found convenient to assemble all of the instruments on a single board and photograph the group at the necessary intervals. Reference to the photographs will furnish any desired readings.

Drainage Yield, Wanaque Watershed

Filling of the 27,800 m.g. Wanaque reservoir of the North Jersey District Water Supply Commission in less than a year gives a daily average yield for the drainage area of 94.4 sq. mi. tributary to the reservoir of 1.1 m.g. per square mile of drainage area.

Control of "Unaccounted-For" Water

Results of Tests and Studies in a Number of Cities

By W. C. MABEE
Chief Engineer, Indianapolis Water Co., Indianapolis, Ind.

UNACCOUNTED-FOR water is defined by the Water Works Practice Manual as "that portion of the water flowing into a distribution system which is not delivered to the consumer." Water waste is defined as "water which is not drawn to serve effectively a useful and legitimate purpose."

Confusion in Classification.—There is often confusion as to the meaning of the term "unaccounted-for water," as will readily be discovered by studying the answers received to the questionnaire sent out by the Indianapolis Water Co.

There is a tendency to group water allotted to public uses, such as fire fighting, flushing streets, sewers, unmetered services, under-registration of meters and underground leakage into a lump and call that unaccounted-for water. Much of this so-called unaccounted-for water is delivered to the consumer and is, therefore, in the language of the definition before quoted accounted for, having served effectively a legitimate purpose.

Water waste is another matter and it may or may not have been measured to the consumer.

If Indianapolis, for instance, were to report its unaccounted-for water as embracing water not metered but used for public purposes, plus leakage and unauthorized use the report would read 18 per cent of its total pumpage; whereas, if a reasonable allotment of legitimate use to public and other known uses is made, confining the answer to the definition above given; that is water not delivered to the consumer, the percentage is 10.7, approximately.

It seems, therefore, that water that can reasonably be accounted for as having been used by the consumer, whether it be the fire department, public street sprinkling, flushing of sewers, water for swimming pools, public parks and municipal buildings or other legitimate purposes, is not unaccounted-for water although frequently classified as such.

No water works system can reasonably be expected to account for all the water that enters its distribution mains. There are unavoidable losses due to underground leaks that it would not pay to uncover and repair, under-registration of meters that in some instances would cost more to keep operating at an efficiency of 100 per cent than the value of the water saved would be worth. There is an economical efficiency beyond which there would be no profit.

On the other hand there are large losses in underground leaks, under-registration of meters and unauthorized uses that could very profitably be recovered. Some of these losses which have recently come to my attention I will touch upon later.

The Economic Limit.—An occasional check up should be made for unaccounted-for water to keep it within bounds.

Unaccounted-for water that exceeds an economic limit is an economic waste; the money value of which will depend upon local considerations, but which will in most instances represent a substantial loss of revenue.

Water that has been purified and pumped represents invested capital in plant, in operation, in materials, in supplies and in maintenance. This represents its value and it should be conserved as other commodities are conserved.

If, by means of water waste surveys, water prevention, more accurate meter measurements, or other means of decreasing consumption without restricting legitimate use, a saving can be effected, that conservation of the water supply means deferring the time when additional supply will have to be provided involving a corresponding outlay for boilers, pumps and buildings.

By the term "economic limit" in implied in the language of E. K. Wilson, chief engineer of the Pitometer Co., in referring to unaccounted-for water and under-registration of meters "that point beyond frequent testing brings in returns less than the cost of the work; probably 85 per cent would be a fair figure."

E. D. Case, vice-president and general manager of the same company, commenting on this same subject in a recent letter to the writer, says: "It is my opinion that every metered city should account for at least 85 per cent of the total consumption, and it is possible by present up-to-date methods to increase this figure to the economical limit."

There is, of course, no hard and fast rule that will apply to all communities alike, and the economic limit in one place would be a different figure in another, depending on local conditions.

Separation of Consumption.—For years engineers have been advocating a separation of consumption into at least two divisions; one being industrial and the other domestic. More divisions are preferable, but these two are indispensable if we are to compare consumption figures, however, having acquired the habit of reporting consumption per capita as one figure without reference to the industrial consumption, we go on reporting consumption in this unscientific manner.

We had occasion recently to study the distribution of water in Indianapolis, where we are about 50 per cent metered with reference to ascertaining the amount of unaccounted-for water that we were pumping into the system and which at first glance seemed to be a large part of our pumpage. As a preliminary step in making this study we decided to compare our consumption of water with other cities and to that end sent out a questionnaire to several hundred cities, large and small, and widely separated.

These answers have been tabulated and show these data in a condensed form, arranged alphabetically by groups according to population, which is made part of this paper.

Analysis of Pumpage at Indianapolis.—The next step was to analyze our pumpage by subdividing it into five groups as follows:

(1) Industrial, (2) Commercial, (3) Domestic, (4) Public and (5) Unaccounted for; tabulating the annual and daily consumption in million gallons and reducing these to gallons per capita per day and to per cent of total pumpage.

The service was itemized as follows:

First — Industrial Use. — Industrial service included railroads, factories, utilities, manufacturing plants, dairies, ice plants, laundries, etc.

Second — Commercial Use.—Stores, offices, clubs, hotels, office buildings, hospitals, schools, colleges, theatres, churches, barber shops, garages, etc.

Third—Domestic Use.—Apartments and residences.

Fourth — Public Use. — Municipal buildings, parks, play grounds, swimming pools, fire protection, fountains, parkway sprinklers, building construction, flushing streets, sewers, water mains and ditches.

Fifth—Unaccounted-for Water.—Unavoidable leakage in mains and services, unauthorized use of water, extraordinary meter slip and water otherwise unaccounted for.

A minimum allowance for under-registration of meters was made for each division where service was metered.

Considering the questionnaire so far

as Indianapolis is concerned our studies disclose the following:

Daily per capita consumption	89.3 gal.
Average daily pumpage	34.83 M.G.D.
Percentage of pumpage registered on customers' meters	56%
Per cent of all services metered	45.8%
Per cent of all domestic services metered	41%
Per cent of industrial and commercial services metered	96½%
Per cent of pumpage unaccounted for	10.7%
If underground leakage and unauthorized water only is considered.	
If unmetered public uses, under-registration of meters, underground leakage and unauthorized uses are combined	18%
Under-registration of meters assumed as about	5%
Frequency of meter testing; at least every six years for small meters, yearly for large meters.	
Have studies of unaccounted-for water been made?	Yes.

These studies disclosed the percentage given, which from an inspection of the tabulation does not appear to be an unusual quantity of unaccounted-for water. No steps have been taken to decrease the amount of unaccounted-for water as yet.

Comparison of Consumption.—Statistics are apt to be misleading unless all of the facts and conditions are known.

To arrive at a comparable comparison the industrial and commercial uses must be excluded from the total, because of the wide variation in industrial use of water in the different cities. The remaining consumption represents public use, domestic use and unaccounted-for leakage or other loss.

In Table I we have been unable to check up average daily pumpage and per capita consumption with population figures in many instances, and have observed a lack of standard practice in the matter of reporting under-registration of meters and in unaccounted-for water.

In general, I believe that most water works superintendents consider unaccounted-for water the difference between the quantity of water metered to consumers and the quantity entering the distribution system. Unaccounted-for water may be classified in the following divisions:

First: Pump slip.
Second: Underground leakage.
Third : Unauthorized use.
Fourth: Under-registration of meters.

Pump Slip.—It has frequently been found that, in the absence of a master meter, the plunger displacement of reciprocating pumps has been taken as the measure of water entering the distribution system the quantity has been grossly exaggerated. Instances have been known where the discharge from a pump has been completely closed and the pump has gone on churning.

Allowances for pump slip are sometimes taken as low as 2 per cent, usually as 4 or 5 per cent and it is not unusual to find upon careful tests that pump slip may far exceed 5 per cent and may be as much as 30 per cent of the theoretical displacement of the pump plungers.

So that in considering data presented, allowance must be made for the source of the information and the judgment of the person supplying it.

Underground Leakage.—Underground leakage usually represents the largest element of unaccounted-for water. It occurs at pipe joints, service connections, broken pipe or broken services, at blow-off connections or in valves. It is caused by poor workmanship in making joints when pipe was laid or has developed from settlement, or injury occurring after pipe was laid and is not infrequently due to electrolysis, sometimes caused by the corrosiveness of the soil and often caused by stray electric currents leaving the metal structure.

While it is possible to make pipe joints absolutely tight, a certain amount of underground leakage is considered unavoidable. Engineers often specify a tolerance of 200 or 300 gal. per inch diameter per mile of pipe in 24 hours in new systems. The Pitometer Co. considers 3,000 gal. per mile of pipe per day a reasonable allowance for unavoidable underground leakage, after all reasonable precautions have been taken to stop leaks.

There are many water systems, no doubt, that have been fortunate enough to keep underground leakage below this allowance, but there are many more that are not so fortunate. For instance:

The City of Chicago in 1926 tested 66 miles of mains in advance of street paving, and found underground leakage of 10,000 gal. per day per mile; 90 per cent of which was stopped.

The City of Philadelphia, now conducting a pitometer survey for water waste, found underground leakage on a section embracing 626 miles of pipe, amounting to 10,250,000 gal. per day, or in excess of 16,000 gal. per mile of pipe per day, which will, as a result of this survey, be reduced to a minimum.

During the past eleven years Chicago has discovered underground leakage on 668 miles of pipe, which has averaged about 13,000 gal. per day per mile of pipe.

The City of Cincinnati, in 1925 and 1926, found and stopped leakage amounting to 5,000,000 gal. per day, or 10 per cent of their total pumpage. The survey covered about 800 miles of mains which is equivalent to 6,250 gal per day per mile of pipe.

The City of Detroit located and stopped leakage in mains and service as a result of a pitometer survey in 1919 and 1922 amounting to 9,500,000 gal. per day over 1,151 miles of mains, which is equivalent to 8,300 gal. per day per mile, since which time the City of Detroit has organized its own pitometer department and carry on continuously.

Underground leakage such as that just described was interceptible on the surface; the leaks were of such a character that the water was readily dissipated into the soil or into the nearest sewer without a showing on the surface. One superintendent wrote in that he was able to discover leaks by observing after a snow storm the wet places in the snow and would mark the spots for future attention. Others inspected sewers periodically to discover abnormal flows which would indicate leaks or excessive waste.

Underground leaks, beginning in a small way, may, after the lapse of time assume substantial size and cause considerable damage by undermining pavement. A break in a water main may exist and continue for an indefinite period, discharging into a sewer manhole and may never be discovered unless a search is made for just such a condition.

Too often service pipes are installed in the same trench, as the house sewer. This is an invitation for trouble, as a leak may occur on the service pipe and the water escape into the sewer without detection.

The aquaphone, or listening device, is often employed to locate leaks. It is often difficult to detect underground leaks by this method in a large city, because of the noise of the busy street. Blow-off connections into streams or sewers may have been left open. Stuffing boxes of valves are frequently found leaking and in many cases are difficult to prevent. The kind of packing used has a large influence on leaks of this character.

Submarine leaks can be discovered by forcing compressed air into the pipe and observing bubbles on the surface.

Longer lengths of pipe are now being advocated to reduce the number of joints and consequently the quantity of leakage; one-third of the joint leakage can be prevented by the use of pipe in 18-ft. lengths.

Results in Various Cities.—One of the most enlightening answers to the questionnaire came from the city of Akron, O., which is 100 per cent metered, where the water department has evidently been studying this question of "unaccounted-for flow" for the past seven years. The percentage of un-

Table I—Composite Water Consumption of Cities Responding to Questionnaire

Number of cities	Total population of cities	Per capita consumption per day gallons	Per cent of pumpage or supply entering distribution mains registered by individual meters	Water alloted to Unmetered Public Use Underground leakage, Under-registration of meters, Unauthorized use or otherwise unaccounted for
160	25,394,427	98.67	.....	.....
123	.....	.....	71.68	.....
121	.....	.....	.....	24.72

Average 158,715.

accounted-for flow for this period averaged 23 per cent, but during the last four months of 1927 had been reduced to 12 per cent of the total pumpage. This reduction was brought about by "conducting a continuous street survey covering hydrant, valve, curb cock, sill cock, and general surface inspection."

Unaccounted-for flow in Akron "includes illegal use of water, leakage, street flushing, testing, sewer flushing, water main flushing, construction, fire fighting and meter under-registration. In Akron practically all new mains are laid by water works force account. "Construction specifications have been changed to require new mains to pass a leakage test of less than 100 gal. per inch-mile per 24 hours."

"Results obtained average less than 30 gal. per inch-mile per 24 hours before actual acceptance." Here, then, is a shining example for the water works fraternity to emulate.

Baltimore, with 19 per cent of its domestic accounts and 100 per cent of its industrial and commercial accounts metered reports 18.4 per cent unaccounted for and allots 8 per cent of this to municipal use and 10.4 per cent to waste (leakage?).

Chicago has a daily per capita consumption of 292.5 gal. and records 31.4 per cent through individual meters, which supply 16.1 per cent of the services. The city engineer reports 10 per cent of the pumpage chargeable to underground leaks, pump slip, etc., and about seven per cent of this to underground leakage.

Cincinnati, which meters all revenue-producing consumption, accounts for 75½ per cent of the total. Water used for fire protection, street cleaning, public buildings, parks, etc., is not metered.

Cleveland, which is 100 per cent metered, accounts for 75½ per cent through meters.

Kansas City, Mo., which is 84.6 per cent metered, accounts for 75 per cent of its pumpage through meters, estimates free water at 12 per cent, waste, leakage and under-registration of meters 10.1 per cent and flat rate domestic 2.9 per cent.

New Orleans delivers 47.9 mgd into its distribution system (110 gal. per capita per day), of which 68 per cent is recorded through consumers' meters. All of the domestic accounts are metered and all of the industrial and commercial accounts except fire-sprinkler connections.

New York City has a daily per capita consumption of 144 gal., uses 867 mgd. and records 26 per cent through individual meters. Three per cent of the domestic accounts are metered and 21 per cent of industrial and commercial. Forty-two per cent of total municipal supply to city is considered unaccounted-for flow and is defined as follows:

"Leakage from plumbing fixtures of domestic consumers and free users is estimated to be 25 per cent of total supply to city; meter slippage 6 per cent of total supply; underground leakage from water mains and service pipes 11 per cent of total supply."

The following comment is made respecting efforts to check water waste:

"House to house inspections have been made to stop leakage from plumbing fixtures as temporary expedients to conserve supply during time of shortage of water. The saving made during such inspections is lost in about two years' time. Underground waste work has been carried on for a number of years with excellent results, but the size of the force engaged in this work has been too small to cover the city in a systematic manner."

Washington, D. C., reports having located and stopped underground leakage amounting to 40 million gallons daily, the daily per capita consumption is now 137 gal. and the total consumption 68.7 mgd., of which 44.2 mgd. is recorded through individual meters; 85 per cent of all water services being metered. No record of unaccounted-for water is kept, due to unmetered use by federal and district government.

Unauthorized Use of Water.—There have been instances where water has been taken from fire-sprinkling connections, from services and from mains and not paid for until discovered by the sleuths of the water department. Sometimes this illegal use of water is unintentional, accidental perhaps, but no such user of unauthorized water will admit that water was taken with malice aforethought.

The illegal use of water is not a recent practice. It was known and practiced in Rome several thousand years ago.

Under-Registration of Meters.—There is considerable difference of opinion touching the subject of unaccounted-for water as affected by under-registration of meters and it is hardly to be expected that there would be an agreement on this subject since the conditions surrounding the standard practice of different communities respecting meters vary so widely.

There is need for standard practice rules and regulations governing meter testing inasmuch as the accuracy of meters affects "Unaccounted-for Water." Some cities have adopted definite testing schedules. Many cities remove and test meters when they stop functioning or when there is a suspicion that the meter is not properly recording flow or when "marked variations occur," "ten years on the average," "when they stop." In general the period set for testing meters, where a rule is followed, appears to be five years. This average was obtained from information supplied by large number of cities which had been circularized.

Acknowledgment.—The above is an abstract of a paper presented at the annual convention of the Indiana section of the American Water Works Association.

Municipal Uses of Water at Springfield, Mass.

The following table from the 55th annual report of the water commissioners of Springfield, Mass., shows the municipal uses of water in that city in 1928. The amounts and quantities shown are for mean year periods. Unmetered quantities in gallons are estimated from amounts, on basis of 6 2/3 ct. per 1,000 gal.—or equivalent of 5 ct. per 100 cu. ft.

Classification	Amounts	Gallons	
*Schools	$ 7,834.70	117,088,100	
*Public buildings (not schools)	4,040.55	60,450,500	
*Public Parks	2,694.40	40,310,900	
*Public playgrounds	466.28	7,921,500	
†Building purposes (streets and engineering department)	477.25	7,158,700	
†Sewer department (flushing)	4,114.03	61,710,500	
*Snow removal (via sewers)	1,232.51	18,487,700	
†Street washing and sprinkling	2,363.15	35,447,300	
†Drinking purposes (for animals)	60.00	897,700	
Total of above	$23,282.87	349,472,900	
Fire hydrant service	61,750.00‡	At $25 per hydrant	
Total municipal use	$85,032.87	(as per registrar's report)	

*All metered. †Unmetered. ‡Not reducible to quantities.

The water commissioners comment as follows on the above figures:

"The foregoing total amount of $85,-032.87 represents a portion of the accrued earnings of the water-works public service enterprise (but at low values) just as much as do the revenues charged to and collected from all private consumers. For proper accounting purposes this amount has to be charged annually to the municipality on the books of the water-works and then charged off as uncollectible, because payment therefor is prohibited by city ordinance."

Progress of the City Manager Plan.—The city manager plan is now in effect in a total of 383 cities in this country, and in 16 cities of Canada. Michigan leads all states in the number of cities under the plan, having 44; Florida follows with 39, California with 33, Texas with 31, and Virginia with 25. Ohio, while having only 19 cities under the plan, has the largest number of people living under this form of government by virtue of its larger cities under this form of government.

Trickling Filter Dosing

A Simple Dosing Apparatus

CONSIDERABLE trouble is experienced in dosing small experimental trickling filters at definite rates and in securing even fairly uniform discharge over the filter area. With a smaller area than served by one nozzle in a large plant it is desirable to reduce the rate of flow through a nozzle, and this adds to other troubles encountered. A simple apparatus that gave satisfactory results is described as follows in Bulletin No. 26 of the Illinois State Water Survey by G. C. Habermeyer and H. L. White.

The apparatus is shown in the sketch. Sewage is pumped into a half barrel placed several feet above the surface of the filter. From this half barrel a short pipe carries sewage to a dosing tank, the top of which is about level with the bottom of the barrel. An overflow pipe is connected through the bottom of the half barrel. By changing nipples on the top of the overflow pipe, the sewage level can be held at any desired elevation, so as to give any desired rate of flow into the dosing tank. It was necessary to clean the short pipe from the half barrel with a test tube brush, daily.

Sewage flows from the dosing tank to the filter through a siphon, a vertical pipe, a trap, and a pipe with a slight slope upward to the nozzle. Siphons and traps of small pipe, with siphon auxiliaries, were tried and discarded. A bell consisting of a 4-in. pipe cap is now used on the siphon.

One auxiliary that was tried with the pipe siphons and also with the bell was a trap of ¼-in. pipe attached to the top of the siphon. This trap was nearly as deep as the main trap and was filled by the sewage flowing into the dosing tank. It was expected that this would give sharp start and stop to the siphon and greatly reduce the quantity of air discharged through the main trap to the filter and thus give more uniform discharge. Results secured with this very small auxiliary were not satisfactory, and it was discarded.

The auxiliary now used consists of a trap of ¼-in. pipe screwed into the side of the bell of the siphon. A detail of the trap and bell is shown in Fig. 1. When the sewage level goes below the top of the outlet pipe while the tank is discharging, sewage is siphoned under the bell until enough air is drawn in to break the siphon. The auxiliary trap is placed at such an elevation that the sewage is drawn from it by the suction created by the siphon, just before air is drawn below the bottom of the bell. The siphon breaks sharply, since the ¼-in. pipe admits air into the bell after the bottom of the bell has been covered by incoming sewage. When the auxiliary trap is not used, the bottom of the bell is covered—by the sewage coming and the sewage falling from inside the bell—before the bell is completely filled with air, and the siphon does not break sharply.

In order that, with the dosing tank nearly empty, sewage could be sprayed onto the central part of the filter at a rate less than the average rate of inflow into the dosing tank, a throttling valve was placed against the end of the inlet pipe into the dosing tank. The valve was operated by a float in the dosing tank as shown in Fig. 1. A wire from the float passed up over a pulley and then down to the valve. As the sewage level lowered when the tank was dosing, the float gradually closed the valve. This reduced the rate of inflow sufficiently to permit the siphon under the bell to break. The valve seat was made uneven purposely, so that a small stream of sewage flowed from the pipe even when the valve was closed. This allowed sewage to flow into the tank when the dosing period was over, thus raising the sewage level sufficiently to open the valve and fill the tank again. This throttling device was discarded because clogging prevented uniform operation, because it was difficult to determine the amount of sewage applied to the filter, because the long time the valve was held nearly closed gave a long time between doses to the filter, and because it was found that the lowest rate of flow from the dosing tank through the nozzle was greater than the average rate of inflow, so that throttling the inflow was not necessary.

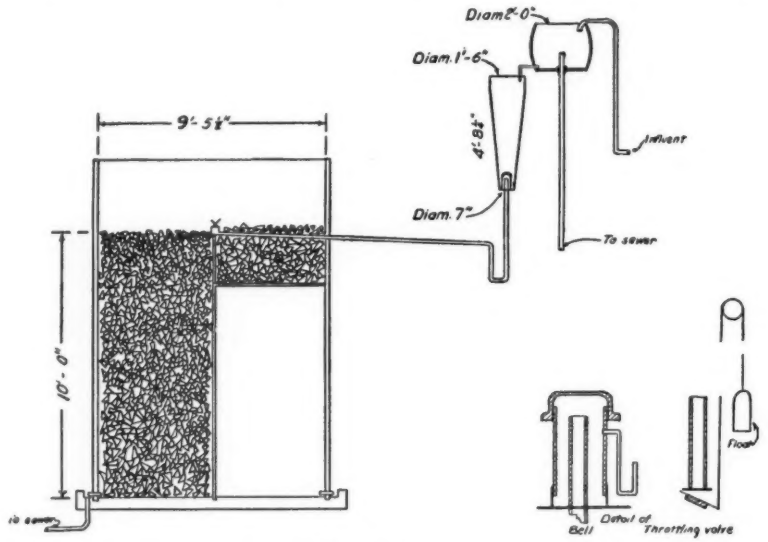


Fig. 1—Details of Dosing Apparatus

A dosing tank was then designed after some preliminary experiments with a barrel. In the preliminary experiments the relation between the elevation of the water level in the barrel above the nozzle, or the head on the nozzle, the rate of discharge, and the distance from the nozzle to the area that was being sprayed, were obtained. Nozzles used in the first tests discharged at a higher rate than desired. The capacity of a Worcester nozzle was then reduced by fastening over the orifice a brass disc with a small circular opening. The nozzle clogged on the first discharge but seldom clogged thereafter. With a nozzle chosen, the proper elevation of the top of a dosing tank to spray to the outer edge of the filter, the elevation of the bottom of the tank to spray close to the center of the filter, and the shape of the tank, were determined. For convenience in making these determinations, radii of the filter were divided into fourths and marked with nails. Water levels in the dosing tank were marked when the spray was to the outer edge of the filter, to three-fourths the radius, to half the radius, and to one-quarter the radius. The relative filter areas between the points marked on the radii were seven, five, three, and one; and, with due allowance for the constant inflow to the dosing tank, this gave the proper relative capacity of the parts of the dosing tank between the marked points. The relative areas, expressed in percentage of the total, were 44, 31, 19, and 6; and the percentage of the total sewage applied to these areas, with the tank designed and with all connecting pipe clean, during two tests, averaged 55, 36, 9, and 0, respectively. The outer 75 per cent of the area was dosed higher than the average. Much of the remainder of the spray fell at a little less than half the radius from the center, giving about 10 per cent of the area sprayed at about normal rate.

As the pipe became dirty the spray fell a little nearer the center and average conditions were better than during any one test. It was considered advisable to have little sewage fall on the inner 6 per cent of the area, as it would fall on or close to partition walls in the filter and flow down the walls.

The sprinkling filter was started on Nov. 30, 1926. Its area was .0016 acres. During the first month of operation the rate was slightly low, and stops were more frequent than later, giving a net rate of 1,800,000 gal. per acre per day. This was increased the next month (January) to 1,900,000 gal. per acre per day; and from that time until Sept. 15, 1927, excepting for a shut down of about 67 hours due to flooding the experiment station by an adjacent stream, the quantity filtered gave a net rate of practically 2,000,000 gal. per acre per day.

Lengths of Filter Runs

Operating Data for Fredericksburg, Va. Filter Plant

By R. J. LEVEQUE
Superintendent of Filtration, Fredericksburg, Va.

THE figures which appear in the space on the operating report devoted to filter runs, always serve as interesting material for study, since these figures are very often indicative of the efficiency with which the plant is being operated, assuming of course that conditions governing any particular plant are known.

The Fredericksburg plant is not quite two years old. Putting the new plant into operation meant that the usual experimental stage would have to be gone through, records kept and data compiled to serve as reference material and operating guides for the future. When records of these runs are compared, they show on the average a steady gain.

How Improvement Was Effected.—This improvement might be attributed to several things but I think that the greatest factors for this increase were the substitution of soda-ash for lime the changing of the point of application of chemicals to the raw water, the latter being the more important.

Formerly the chemical feed pipes injected the coagulants into a T on the discharge side of the low service pumps. This T was located closer to the discharge into the left basin than it was to the right basin. With both basins being supplied by this raw water line, it naturally followed that the left basin being nearer the point of application, received the bulk of the applied water. The water going to the other basin as a result was undertreated. It was impossible to get an even distribution, consequently proper settling could not take place. This increased my filter loads and shortened my runs considerably.

The coagulants are now applied 15 ft. ahead of the raw water pumps. The results are nothing short of marvelous. A thorough mix is obtained in passing through the pumps and into a pair of splendid mixing chambers of the "around the end type." Both basins are now equalized in the amount of treated water received and we are now able to utilize and reap the benefits from our rated settling period.

Importance of Jar Test.—With this handicap removed, I have been able to lengthen my filter runs still further by devoting much time and attention to the "floc." As good filter performance is greatly dependent on the condition of the floc, I would like to stress the importance of the jar test, especially to the operator of the small plant. It eliminates guesswork. Very often a floc will look good in the basins, and, yet many times it is possible to obtain a still better one. Dipping up a few jars of the coagulated water and changing the proportions of the chemicals makes it possible to observe and compare the results of each altered dosage. Frequently the best settling takes place in the jar to which the least amount of chemicals have been added.

In my daily tests I take a pH of the jar contents giving the best results and hold the water going to the basins at this optimum. At Fredericksburg the best coagulation seems to be effected at the range between 6.6 and 7.0.

Conditions Reducing Filter Runs.—Some valuable experience was gained last year in coping with conditions that tended to reduce filter runs. The first was algae. No growths appeared in the basins, and the raw water had a turbidity of less than 15 parts per million and the only indication that anything was wrong was a stringy floc and a pronounced grassy odor to the water. A chance walk up the canal to the dam where the water was calm, revealed the trouble. The surface was coated with a green scum. This year I was able to check this with copper sulphate at the first appearance of the stringy floc and instead of having prolonged short runs, as before under similar circumstances, this time in two days, I was able to start the filters back to normal runs.

The second condition was air-bound filters, especially noticeable in the spring and fall of the year. My gauges did not show any great loss of head and yet the filters would not pass their required amount of water. A careful check-up for leaks in the valve-stem packings, and the tightening of any that were doubtful relieved the condition somewhat, but I presumed that this condition was caused more by the sudden temperature changes in the water. My method of getting around this situation, was to close the effluents on any ailing filters for a few minutes, which permitted the air to rise to the surface. Using the re-wash after this and then putting the filter back into service did away with the necessity for washing for several hours.

Use of Re-Wash Valves.—I have a few words regarding the proper use of the re-wash valve, after a filter has been washed. Using this valve from 3 to 10 minutes at this time not only will lengthen a filter run but will also improve the quality of the effluent. I have noticed of late that a filter washed just prior to shutting down the plant for the night, gives from two to five hours longer run than those washed at any other time. The natural settling that takes place over night seems to form a splendid unbroken mat over the sand bed, which apparently, is even better than the one formed by using a slow rewash, due perhaps to the fact that no fine particles are drawn down into the bed. Of course in the larger plants, extra units make it necessary to return a filter to service immediately after washing, but I am sure that if any small plant can spare a washed filter, if only for thirty minutes before putting it back into service, thus permitting a natural formation of the mat, that their filter runs will be materially increased.

Supplementing these operations, it is of course understood that the proper care of filter beds must be undertaken and that they must be frequently probed for hard spots, cracks and dead areas, together with the inspection of the sand surface for mud balls.

Cleaning Basins.—The frequency with which a coagulating basin should be cleaned is dependent upon how much suspended matter the raw water contains, how much coagulant is used, how good the floc secured and other factors. The time for cleaning is easily observed by old "floc" being raised up from the bottom of the basin and carried over onto the filters, the appearance of gas bubbles, and by measuring the depth of the sludge. For this latter method I attached tin cans to a pole at intervals of 6 inch for a distance of 6 feet. The uppermost can containing sludge gave an approximate depth of the settled matter.

We cleaned our basins for the first time, six months after the plant had been in operation. The accumulation of sludge was so great that to wash it out by ordinary methods was deemed inadvisable for reasons which are here given.

The plant at Fredericksburg is situated in a hollow. A ditch drains this lowland, emptying below the town. This same ditch is used by us as a drain, the plant being erected directly over it, and to empty this great amount of sludge into the run, would have clogged underneath the plant.

A force of men was assigned to remove the greater portion with shovels and buckets. This proved a very laborious task and four days were required to clean both basins. On that basis, washing basins proved expensive, and so it was decided to wash them out in the future, at regular intervals of from two to three months.

This enables one man to accomplish the job in one and a half hours.

The design and construction of our

sedimentation basin at Fredericksburg makes the cleaning a short and easy operation. Due to the pronounced slope of the floor of the basin to the draining gutter, a great deal of the sludge is washed out during the draining process, which reduces considerably the amount to be washed out with the hose.

When the water was drained down to about 6 in. above the sludge we commence loosening the sludge in the farther end of the basin with the hose. By the time the draining is finished, one end of the basin is practically cleaned. As different batches of sludge are loosened by the hose, I open the connecting gate between basins, allowing water from the other basin to come in and fall over the weir, the entire width of the basin. This keeps the sludge thin, and enough water is used to carry the loosened sludge down over the whole area of the basin.

Washing more frequently has proved more economical for us and clean basins are assured at all times.

Acknowledgment.—The above paper was presented April 25 at the First Virginia Conference on Water Purification and Sewage Treatment.

Chlorinated Copperas as Coagulant

Experiences at Chickasaw, Mobile County, Alabama

By A. CLINTON DECKER and H. G. MENKE

Respectively, Sanitary Engineer, Tennessee Coal, Iron & Railroad Co. and Chickasaw Utilities Company, and Assistant Sanitary Engineer, Alabama State Board of Health.

THE Chickasaw water works system supplies water to the towns of Chickasaw, Ala., and Prichard. Chickasaw is a town built by the United States Steel Corporation during the war to provide housing facilities for the employees of the Chickasaw Shipbuilding Co., a subsidiary of the corporation, and is located about seven miles north of Mobile. The present population of Chickasaw is about 2,000. The town of Prichard is an incorporated municipality having a population of approximately 1,500. The water works plant at Chickasaw was built by the steel corporation in 1918 to supply water for domestic and industrial purposes for the village and plant.

The Water Works.—About 18 months ago, the Alabama Water Service Co., with general offices in Birmingham, secured a franchise for supplying water to the town of Prichard and negotiated a lease with the Chickasaw Utilities Co. for the operation of these properties to supply water to Chickasaw, Prichard, and adjacent territory. The plant at this time consisted of a pumping station, plain sedimentation basins of 1,000,000 gal. capacity, an elevated steel storage tank of 200,000 gal. capacity, and a very complete distribution system. The source of supply for this plant was Eight Mile Creek which originates in springs and flows through heavily cypress wooded territory. The water has a color ranging from 40 to 130 parts per million; the turbidity normally varies from 3 to 25 parts per million and on very rare occasions reaches 50 parts per million; the alkalinity ranges from 2 to 5 parts per million; and the pH ranges from 5.5 to 5.9. The bacterial count is usually low—mostly under 100 per cubic centimeter. In the original plant, provision was made for chlorinating the water as it was drawn from the settling basins and pumped to the elevated storage tank.

The filtration plant is an entirely new unit of the Water Works System at Chickasaw. The construction of this unit was begun the first week in January of this year and completed April 6th.

Because of the possibilities which preliminary studies had indicated as being presented at this plant for successful use of "chlorinated-copperas" as a coagulant, the authors invited L. H. Enslow, of the Chlorine Institute, who had first suggested the use of this coagulant at Chickasaw; C. Arthur Brown, Chief Engineer, Bureau of Water Purification, American Steel and Wire Co.; C. P. Rather, Chief Engineer of the Alabama Water Service Co.; and G. R. Kavanagh of the Wallace and Tiernan Co., to be present during the experimental operation of the plant from April 9th to 19th, inclusive, for observation and such suggestions as they might make looking to the development of this process, or modifications thereof, as would best meet conditions presented by the soft water of low turbidity and containing considerable color of vegetable origin. All of these men were present except Mr. Enslow, who, although unable to come to Mobile at that time, kept in close touch with the progress of the operation of the plant.

Feature of Filtration Plant.—In designing the new filtration plant, one of the two basins formerly used for plain sedimentation was converted into the coagulating basin, part of one end of which was divided into seven rectangular mixing chambers 4 ft. square and 10 ft. deep, connected at the bottom by 12 in. 90° ells with 18 in. nipples, giving an upward velocity to the water as it enters each successive chamber. The total retention period in the mixing chamber is 12 minutes. The total capacity of the coagulating basin is approximately 500,000 gal. The iron sulphate, sodium aluminate, and lime used in treating the water are fed through Wallace and Tiernan dry feed machines and the chlorine is fed through a Wallace and Tiernan Type MSV chlorinator. In order to obtain complete oxidation of the ferrous sulphate, a lard barrel was used for the introduction of both the sulphate and chlorine in such a way as to cause a churning and swirling action, the resultant mixture from this barrel passing to the first mixing chamber where the raw water is introduced. The spot test, using the potassium ferricyanide, was used as a control at frequent intervals throughout the period of operation. Water was pumped at the rate of 700 gal. per minute from the coagulating basin to the filters which consist of two rectangular units each having a capacity of one half million gallons per 24 hours.

Operation of Plant.—The plant was operated both continuously and intermittently. When operated intermittently, the period of operation was 10 hours and remained idle 14 hours. Coagulation was obtained by the use of "chlorinated-copperas" alone and also in conjunction with sodium aluminate. When sodium aluminate was used, it was introduced into the third chamber of the mixing chambers after a theoretical detention of 4 minutes in contact with the copperas. A good floc had already appeared in the second chamber from the use of "chlorinated-copperas" alone. Good coagulation was obtained by using .7 grains per gallon of iron sulphate and .126 grains per gallon of chloride. Although this quantity of chlorine gave excess of 2 parts per million at the end of the mixing chamber, all residual chlorine had disappeared before the water had reached the end of the last day of the coagulation basin. Sodium aluminate, when used, was introduced at the rate of .4 grains per gallon.

Provision had been made for introducing lime at various points in the last bay of the coagulating basin and also into the clear water well. At different times the lime was introduced at a point about 50 ft. from the coagulating water pump, 130 ft. from the coagulating water pump, and into the clear water well immediately adjacent to the filter effluent pipes. When introduced into the coagulating basin, the effluent was not as satisfactory as the final treated water was found to be after the introduction of lime into the clear water well. Although there was a very slight increase in color when the lime was introduced into the clear water well, the color was not as great as the filter effluent was when lime was introduced into the coagulating basin. In all cases, lime sufficient to adjust the pH up to 7.0 or 7.2 was used. The alkalinity was raised to 7 or 8 parts per million. The final color was probably not more than 3. This, however, is an estimated figure, as the lowest disc of the U. S. G. S. color standards which we had was for a color reading of 7. When "chlorinated-copperas" was used alone, for the floc obtained was apparently lighter and was carried in comparatively large quantities a greater distance through

the coagulating basin than was the floc obtained when sodium aluminate was added as described above. However, it was noted that the floc when sodium aluminate was used, was more agglomerated and, although a heavy deposition occurred in the first third of the first bay of the coagulating basin, the remaining floc seemed to have a less specific gravity than that resulting from the use of "chlorinated-copperas" alone. The final treated water obtained, when sodium aluminate was used, was only very slightly different from that obtained when "chlorinated-copperas alone was used for coagulation. No difference could be detected by the ordinary laboratory tests. When viewed through a 10 ft. depth in the clear water well, the opinions of five observers differed as to which effluent was the better or whether there was any perceptible difference whatever. It will thus be seen that the difference in results in the particular water being handled during these experiments would make the additional cost of sodium aluminate questionable — this cost alone being greater than that of all three other chemicals combined.

It must be remembered that this is an absolutely new filtration plant, that the sand has not ripened, and that the period of operation has not been sufficient to demonstrate conclusively what might be expected under the varying conditions of water which will be found through a twelve months' period. However, although these results are not final, we are convinced that this method is practical, economical, and efficient under conditions similar to those now existing. The efficacy, when water of a different quality must be treated, can be determined only after further observation.

Acknowledgment.—The foregoing is a paper presented at the First Virginia Conference on Water Purification and Sewage Treatment, held at Richmond, Va., April 25 to 26.

State Supreme Court Uphold Ohio Sanitary District Law

In a decision handed down March 27, in a case on appeal from the Mahoning county courts, the Ohio Supreme Court affirmed the constitutionality of the sanitary district law, which had been attacked by two citizens of the Mahoning Valley Sanitary District as taxpayers, on the alleged ground that the legislature could not delegate power and authority to levy taxes to an appointive body. Commissioners of the sanitary district are appointed, instead of being elected. Plaintiffs lost in the Mahoning County Common Pleas Court, and appealed on error to the Court of Appeals, which affirmed the decision, and appeal to the Supreme Court followed. This decision removes the last existing legal barrier to progress of the sanitation work designed to furnish pure water to the cities of Youngstown and Niles.

Automatic Devices in Filter Plant

Care and Adjustment of Controller Gauges and Other Mechanical Equipment

By RICHARD F. WAGNER
Director of Safety and Water, Lynchburg, Va.

The city of Lynchburg was very fortunate when securing its purification plant in that the parties charged with its design appreciated the value and importance of certain automatic devices and spared no efforts or expense to secure them.

Automatic Devices.—The more important automatic devices were the following:

1. One 24 in. venturi rate controller, with a register-indicator-recorder and special electrical transmitting device, for operating the chemical feed controllers.

2. Three chemical feed controllers automatically operated electrically from the register-indicator-recorder.

3. Twelve 6 in. self-contained filter rate controllers, one 6 in. wash-water rate controller, and one 12 in. wash-water rate controller, with 14 special rate of flow indicators.

These controllers, consist essentially of a venturi tube, with hydraulic gate valves in the down-stream cone. The movement of the gate valve is controlled automatically so as to maintain a constant rate of flow regardless of pressure variations. The method used in the utilization of the difference of pressure from the venturi tube applied to a diaphragm which in turn operates a pilot valve which controls the movement of the hydraulic gate. The setting of the rate at which the controller operates is accomplished by moving a weight on a graduated scale beam.

A check of the proper working of the controllers is secured by the rate of flow indicators, which consist of a glass tube projecting into a well of mercury with the necessary connection of the meter tube, the difference in pressure causing the mercury to fluctuate in the glass tube.

Care of Packing.—The cylinders of our hydraulic gate valves are brass, so are the gate girders. After a few months' operation of the plant, some of the controllers became sluggish and in some instances it became necessary to remove the caps of the cylinders of hydraulic gates for the purpose of renewing or replacing packing around plunger. This packing, of course, hardens under use and it has been our practice to hammer it back to life after washing it thoroughly in a strong solution of soda ash. We then coat it thoroughly with a mixture of extra light petroleum jelly and flake graphite. It is of a good deal of importance to replace or renew packing in such a manner as to prevent a displacement of gate stem. This we have accomplished by measuring the distance of stems from cylinder walls in four directions before removing packing, taking care that such measurements are accurately secured upon the completion of the repair job.

We have also found that the insertion of a set screw in gate girder stem will prevent too tight a shut down; the screw being set in such a position as to present a complete seat.

We have experienced little if any trouble with diaphragm boxes, taking the precaution, however, of removing tops at certain intervals and cleaning boxes thoroughly.

Our pressure gauges, recording and otherwise, are checked from time to time by a gauge tester, a device every water plant should possess. This tester works by series of weights with glycerine as the fluid used.

Chemical Feed Controllers.—While our chemical feed controllers were designed to work automatically by an electrical device geared to our venturi meter, we found this method impracticable, we, therefore, calibrate the flow from orifice boxes manually once an hour, a program clock calling the attention of the operator on duty to this task. This method has been eminently satisfactory, chemicals consumed being checked once daily against the rate of application. All the attention the chemical feed devices require is a complete cleansing at certain intervals.

Care of Chemical Pumps.—Chemical pumps of the piston type, especially such pumping alum solutions require frequent grinding of valves, which we accomplish identically in the same manner an automobile mechanic grinds the valves of your car, very little practice will soon make your operator an adept in this game.

Though we use chlorine but seldom, we possess three units to apply such gas. We subject these to periodical tests, sometimes with gas, then again with air. One thing of importance, of course, to prevent corrosion and assume long life of this apparatus is to prevent leaks, even the smallest; doing so requires painstaking, thorough attention of the operating personnel.

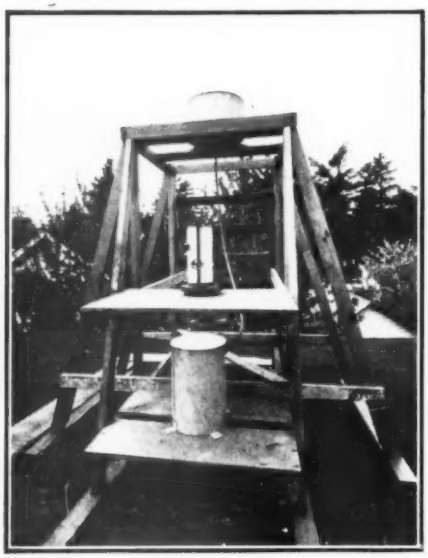
Any plant designed and constructed in accordance with the latest methods will not function properly unless the person in charge of operation is intelligent and has the proper sense of responsibility. This person will soon sense the fact that automatic devices, gauges and other equipment are valuable assistants and will treat them accordingly. He will insist that his personnel also become acquainted with them thoroughly, from the inside out, and that a deal of elbow-grease be applied in keeping them clean and certain surfaces sparkling.

Acknowledgment.—The foregoing is a paper presented at the first Virginia Conference on Water Purification and Sewage Treatment, held April 25 and 26 at Richmond, Va.

Recent Developments in the Water Works Field

A Simple Recording Rain Gage

Leupold, Volpel & Co., Portland, Ore., have recently adapted the Stevens Type L water level recorder to the recording of rainfall. A collecting tank is mounted on a suitable platform and is connected by flexible rubber hose to a float tank. The recording instrument is



Recording Rain Gauge Mounted on the Roof of a Building

placed over the float tank and records the elevation of the water in the tank. The collecting tank and the float tank are so proportioned that any desired magnification of record can be secured. In the bottom of the float tank is a stop cock by which it may be emptied at the time the clock of the recorder is wound.

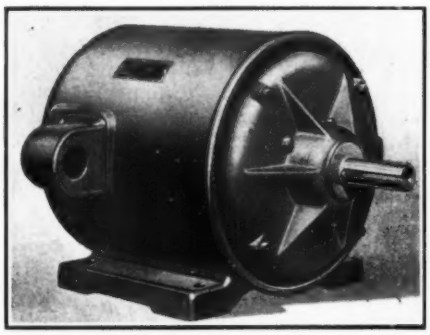
The graph made by the recorder is a mass graph of rainfall by means of which the total amount and its intensity may be readily determined. The illustration shows the recording rain gage mounted on the roof of a building. The collecting tank area is 2.4 times the float tank area. The chart on the recorder is graduated in hundredths of feet with each tenth line accented. Each tenth of a foot therefore on the chart corresponds to a half inch of rainfall, the record being magnified to 2.4 times. Any other scale of magnification can be secured. The instrument shown is a weekly recorder giving a space of about 2¼ in. per day. In cases of heavy rainfalls with great intensities, the same recorder is used, but a daily or a 12-hour chart is substituted and the clock is geared so that the drum makes one revolution in one day or 12 hours. When there is no rain the pencil makes a continuous line, but whenever railfall occurs a record of the amount and intensity is assured to a time scale that will be legible. The daily chart corresponds to a scale of 18 in. per day, with the smallest division of time representing 10 minutes. In the case of the 12-hour chart, the day space is 36 in. and the smallest division represents 5 minutes.

For isolated localities that cannot be visited once a week, a recorder is used that will run one or two months with one setting. In such cases a float tank is provided that is deep enough to hold any amount of rain that might occur during such a period.

During the dry periods following a rain the graph will show a slight decline due to evaporation from the tank. This however is of no consequence, because whenever a rainfall occurs the total amount and the intensity can readily be determined above the point shown by the graph at the beginning of the rain.

New Motors Developed by The Louis Allis Co.

Experience of 1928 assisted The Louis Allis Co. of Milwaukee, Wis., in developing enclosed motors of reasonable size. These are the explosion-proof, self-ventilated motor for use in explosive atmospheres; and the enclosed self-



Louis Allis Enclosed Self-Ventilated Motor

ventilated motor for applications involving less hazard but requiring a fully enclosed motor. These developments, together with our Resistallis protective coating for the windings of open motors, fill industry's need for motors of reasonable size suitable for applications involving various degrees of hazard either to the motor winding or the surroundings. To machinery manufacturers the outstanding advantages of these three types of protected or enclosed motors are that they are small enough for mounting direct on the driven machine. These motors enable the manufacturers to adapt standard machines, built to accommodate standard motors, to hazardous and semi-hazardous industries. The features of the three types are noted briefly below.

The explosion-proof motor is fully enclosed and self ventilated. It has been tested and listed by Underwriters' Laboratories for use wherever gasoline, or liquids of equivalent or less hazard such as other petroleum products, ethyl alcohol, methyl alcohol, and acetone, are made, used, or handled. When direct connected to machines in explosive atmospheres, thus eliminating belts, this motor eliminates the serious hazard of fire from sparks due to belt static. It is only slightly heavier than an open motor of same capacity, can be installed in same space and is interchangeable in mounting dimensions.

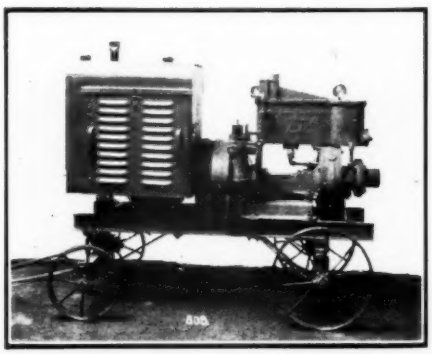
The enclosed self-ventilated motor is fully enclosed and sealed against excessive dust, moisture, oil, acid, alkali, fumes, and other foreign matter. It is cooled by the surrounding air forced through the outer shell over the surface of the enclosed motor frame. Clean air is not required. There are no pipe connections or air ducts. It is only slightly heavier than an open motor, installed in same space, and is interchangeable in mounting dimensions.

Resistallis coating protects windings of open motors and makes them suitable for installations where considerable quantities of organic dust, iron dust, moisture, acid, or alkali are present. Resistallis entirely covers coil ends and slots, is not affected by temperature and does not affect ventilation. It makes a standard motor suitable for reasonably severe duty without added cost.

Self-Priming Portable Centrifugal Pump Announced

One of the latest features of the Domestic Engine and Pump Company's line of water works equipment and one of their most popular units is a self-priming centrifugal pump. Their factory is located at Shippenburg, Pa.

With this automatic primer attached to any of our standard centrifugal pumps it is only necessary to submerge the end of the suction line in water and start the engine. It is not necessary to put water in any part of the pump,



Domestic Automatic Priming Centrifugal Pump

suction line or primer. With a tight suction line it is possible to create a 27 in. vacuum which is equivalent to a 30 ft. suction lift. This primer has been tried out over a period of several years and has proven very successful.

Another new unit is their 1929 Model 164 open spout diaphragm pump with force attachment. They have increased the practical range of diaphragm pump uses by manufacturing an attachment whereby the Domestic open spout diaphragm pump can be converted into a force pump, for temporary use, in a short length of time and with the aid of only one tool, a monkey wrench. They have, in manufacturing this attachment, given the user of such type of pumping equipment something that has been very much needed for some time. It often happens that when using a diaphragm pump the need arises to temporarily force the water away from the scene of action and with this attachment the process is simplified greatly.

Oxweld High Strength Welding Rod

An improved bronze welding rod, designated Oxweld No. 21 high strength bronze welding rod, has been placed on the market by Oxweld Acetylene Company, 30 East 42nd Street, New York City. This rod is recommended for all bronze welding applications including the fusion welding of brass and bronze, bronze-welding of malleable and gray iron castings, joining dissimilar metals and building up bearings

Bronze-Welded 6-in. Galvanized Water Line

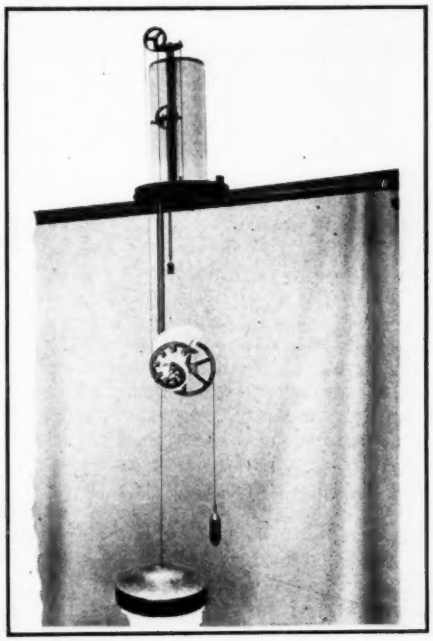
and other wearing surfaces. Due to its composition it has a uniformly low melting point and easily controlled flow. It produces a weld metal as hard and wear resistant as that formerly made with manganese-bronze rod. By its use, tough and ductile weld metal having a tensile strength of over 45,000 lb. per sq. in. can be produced. This is about 15,000 lb. per sq. in. in excess of the strength obtainable with earlier bronze welding rods. In addition, it will make a much stronger bond with ferrous metals.

Properties of this rod eliminate almost all boiling and fuming of the weld metal. Annoying fumes are reduced to a minimum and elimination of oxide and gas inclusions is a reason for both the remarkably sound and strong weld metal produced and the better adhesion to iron and steel.

Oxweld No. 21 high strength bronze welding rod has been thoroughly tested in the laboratory and in the field. It is believed that it will greatly widen the already broad scope of the most versatile of all the oxy-acetylene operations, bronze-welding.

A New Flow Recorder

The illustration shows a device recently perfected by Leupold, Volpel & Co., Portland, Ore., manufacturers of Stevens water level recorders and indicators, whereby the flow in second-feet, gallons per minute, liters per second, or



A New Flow Recorder

any other unit may be recorded on a chart to a uniform scale.

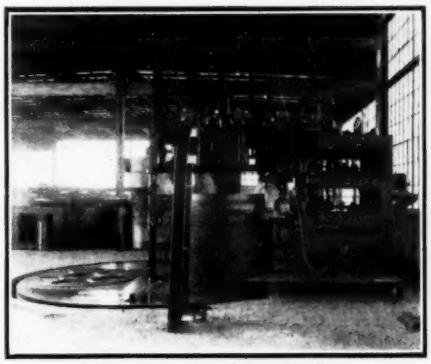
Attached to the base of the instrument is a float pulley which actuates an adjustable spiral cam, which in turn actuates the recording pencil on the recorder. For weirs, sewers, flumes or ditches, where the rating is known or for any device where the height of water is an index of flow the cam may be adjusted so that the pencil will record the flow in any desired units. The spiral is a strip of rubber in which a groove has been milled that is held by clamps. If the rating of a device is known, the rubber cam is clamped in such a position that at all points the pencil will show the correct flow corresponding to these heights.

The instrument may also be provided with Stevens volume meter, which is a totalizing device by means of which the total volume passing in gallons, acre-feet, or any other unit or quantity is registered on dials.

When required, an additional pencil is provided that will record head at the same time, so that this simple device may be used to record head of water, flow, and total volume.

Quinn Develops New Machine

An improved Quinn machine for the manufacture of concrete pipe in sizes 18 in. to 60 in. in diameter and lengths



Quinn Improved Pipe Machine

of 4, 5 and 6 ft., tongue and groove pipe ends. The Quinn Wire & Iron Works of Boone, Ia., are the manufacturers.

This machine has a capacity of from 75 to 100 tons per day depending on the size of pipe being made. It makes either plain or reinforced pipe, single or double reinforcing. The tamping mechanism on this machine strikes a very powerful blow, in fact when the jackets are removed from the concrete which is done immediately after the pipe is made, the material is so dense and hard that it is almost impossible to dent same by applying pressure to the outside or inside.

The improved Quinn machine has the advantages over other processes of making concrete pipe in that it not only makes a pipe economically, but it produces a pipe of the very highest strength, owing to the fact that it uses a semi-dry mix with very little slump and just enough water to hydrate the cement and by applying the terrific trip hammer blow of from 600 to 700 lb. each blow. Operating 370 times per minute, the hammering effect produces a very dense, hard and compact material as it is forced into the forms. This process develops a very high strength in the concrete, eliminates all air pockets and forces the material together in a dense mass. This also gives a very low absorption.

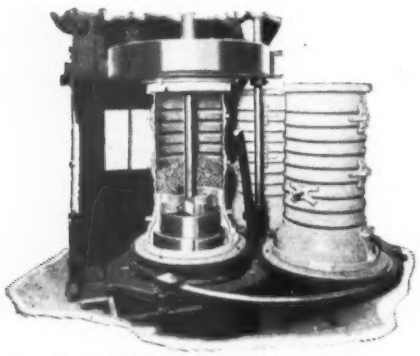
It has been demonstrated from various tests made of Quinn pipe in the larger sizes that the first crack test exceeds all other processes on the market today. Purchasers of pipe and engineers in charge are realizing more and more the importance of high strength in their concrete for sewer work and to this end are recognizing the first crack test as being the most important.

Longer Concrete Pipe Manufactured

Engineers, officials and contractors who specify, approve and use sewer pipe, will be interested in the announcement that McCracken corrugated concrete pipe are now made in three-foot lengths instead of thirty-inch lengths as was formerly the case.

McCracken concrete pipe are made in a number of strategically located local plants. These plants operate concrete pipe machines, manufactured by the McCracken Pipe and Machinery Corporation, Sioux City, Iowa. The company announces a second improvement in concrete pipe manufacture which increases the daily output of each plant and results in a definite improvement in the product.

The McCracken machine automatically manufactures sewer pipe from six



Showing McCracken Wall Packer at Bottom of Its Stroke

to twenty-four inches in diameter, three feet long. Each pipe is made in a steel jacket which is released from the green pipe immediately the product has been wheeled to the curing room.

In every McCracken pipe plant a conveyor line keeps the mixer supplied with raw dry materials and the mixed concrete is discharged into the elevator boot of the pipe-making machine. From that point to the completion of the manufacturing cycle, the operation is automatic. The elevator lifts the mixed concrete above the mold, which stands on a revolving table, depositing it in a circular batch hopper just above the mold.

Hence the concrete feeds automatically into the mold when the revolving wall packed reaches the bottom of its downward stroke. At this point the auxilliary bell packing head is at its top position making the bell or socket of the pipe. This requires from five to seven seconds. At the same time the wall packer on the main vertical shaft is packing the shoulder above the socket. Then the two packers draw apart—the bell packer moving out of the finished socket and the wall packer rising through the pipe packing the wall as it rises.

Until quite recently as much time was consumed in sending the wall packer down through the mold, which is an unproductive trip, as was consumed in bringing it up through the mold during its packing operation. Thus 50 per cent of the time of the wall packer was unproductive. An improvement of the machine has resulted in cutting the unproductive time of this unit down to 20 per cent. In other words, it travels on its downward trip much faster than it travels on its upward trip. This not only speeds production but results in a definite gain in quality.

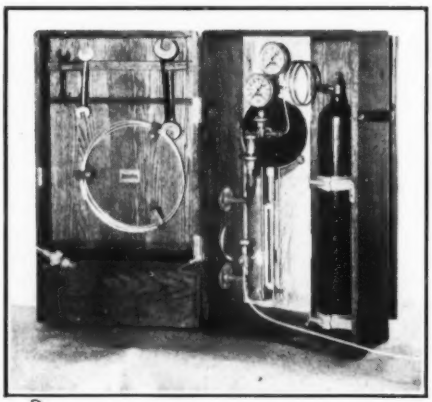
A New Portable Chlorinator

The Paradon Manufacturing Company, Arlington, N. J., have developed a portable chlorinator which can be moved about from place to place as conditions require.

The apparatus consists of a standard Paradon dry feed chlorinator housed by means of brackets in a sturdy oak cabinet. This cabinet is self-supporting. The cabinet is provided with a door on both front and rear. The gauges and control handles of the chlorinator are so arranged as to be accessible from either the front or rear door. The front door is constructed so that the wrenches and other auxiliary equipment supplied with the chlorinator can be stored loosely in the recesses provided. A 12 lb. cylinder of chlorine is attached within the cabinet by adjustable clamps.

All of the parts of the apparatus are interchangeable with the parts on the standard Paradon Chlorinator. This insures prompt service in connection with replenishment of parts. The equipment can at any time be removed and set up on a pedestal and it then becomes a standard permanent chlorinator.

The chlorinator is of the direct feed type. No auxiliary water supply or piping is necessary for its operation. Chlorine can be applied against pressures up to 25 lb. per sq. in. without any additional equipment. Capacities range from .04 lb. to 3 lb. per 24 hours, from 1 lb. to 5 lb., from 5 lb. to 25 lb. and from 25 lb. to 125 lb. The apparatus can be provided with all four ranges, if desired. Any desired capacity from 125 lb. to 300 lb. chlorine per 24 hours can be supplied if required.



Paradon New Portable Chlorinator

The apparatus is provided with a shut-off valve which enables chlorine gas to be kept in the machine at all times under pressure, thus eliminating the possibility of water or moisture getting back into the apparatus and affecting its proper operation.

The uses of the portable chlorinator are many. It is a convenient device to have around a water works plant. One very useful purpose it serves is to provide means for sterilizing mains at all times. After a main is constructed and before it is put into use it can be effectively sterilized by means of this device. Dead end mains, showing signs of after contamination, can likewise be sterilized. The portable chlorinator can be used as a standby for the regular chlorinator. It can be used for prechlorination, algae control, odor control, color control, coagulation control. It can also be used for the application of sulphur dioxide in dechlorination, for carbon dioxide, and so forth. This unit was originally developed for the Water Department of the City of Syracuse where one has been in service with success for several months.

McCloskey Announces Torch Attachment

The McCloskey Torch Company, of Toledo, Ohio, announce their new Cyclone burner. The torches which are not equipped with this burner can

McCloskey Torch Equipped with Cyclone Burner

readily be converted by using an adapter for the purpose.

McCloskey torches are made in two halves, of rolled and pickled deep drawn steel and welded together. Sufficient cast iron counter balance pressed in the bottom absolutely prevents them from being knocked over.

The No. 1 large size torch, the manufacturer states, is made of 13 gauge metal, holds a quart of kerosene, and burns for 48 hours. The No. 3 size is 15 gauge metal, holds 3 quarts and burns 36 hours.

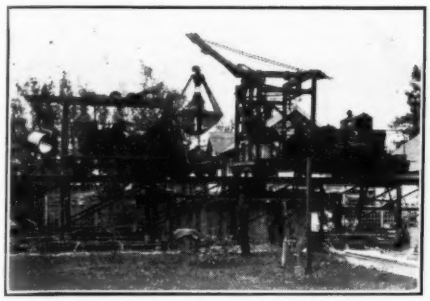
Further information may be obtained from McCloskey Torch Co., Toledo, Ohio.

Potter Improved Trench Excavator

The new Potter trench excavator handles a wide range of work and has built sewers of pre-cast construction from a diameter of 2 ft. to 8 ft. and in depths from 8 ft. to 35 ft. and widths up to 14 ft. The standard length of the trestle is 200 ft.

This machine is manufactured by the Potter Manufacturing Co. of Indianapolis, Ind.

Two standard double drum Lidgerwood gasoline hoisting engines are used for power, the one on the derrick car is a Buda 50 hp. engine and the



Potter Trench Excavator and Conveyor

one on the conveying car a Buda 30 hp. The clam shell is a ¾ yd., narrow type, heavy duty Owen bucket.

The whole machine can be moved ahead at will on railroad rails as each bent leg has a double flange wheel that runs on the rail. The bents are spaced 10 ft. apart and the track gage at the bottom is 10 ft. 4 in. and the track gage on top is 10 ft. 4 in.

The conveying car is a combination hoist and conveying car and receives the excavation from the clam shell and conveys the excavation back and dumps it on the completed work, while the clam shell is going down after another bite, thus doing double work.

The hoist feature lowers pipe into the ditch and does general hoisting work, such as pulling sheeting and bracing timbers out of the trench.

A vast amount of work can be accomplished with this machine and the use of it makes a clean organized job, all operations being carried on simultaneously, the excavating, sheeting, pipe laying and back filling. It is not necessary to pile the excavation on the abutting property owner's front yard or property. The machine handles work in narrow alleys, up city streets or out in the open. It permits the operation of street car and vehicular traffic in city streets where the sewer is on one side of the street.

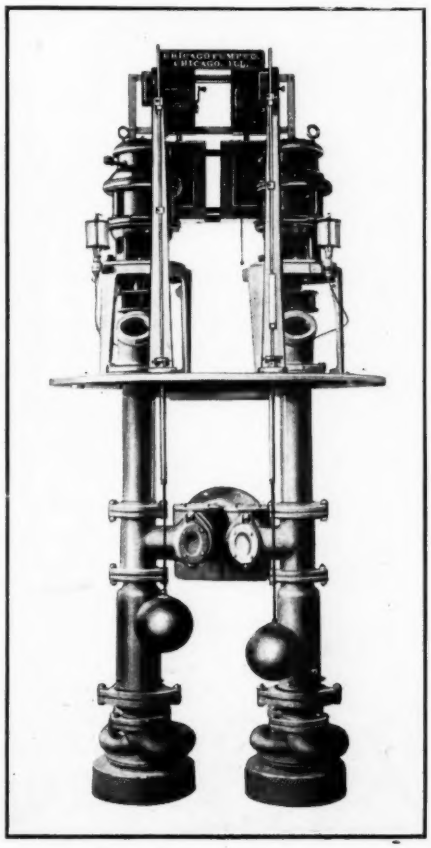
It requires two operators for the machine, which are at all times directly over their work. The operator on the derrick car can spot his bucket in the ditch with great accuracy and can move from one digging section to another with practically no loss of time and can handle as many digging sections or steps in the ditch as is necessary, according to the depth and the type of sewer required. The conveying car operator can spot the back fill in a most advantageous way, to extract the sheeting and bracing in the most economical manner. This enables the operation to become speedy and efficient.

The machine has surpassed the expectations of each sewer contractor that has used it, and has completed work far ahead of schedules laid out, the manufacturer claims. It has been used on small contracts and one up to $2,000,000. This machine has been very much in favor with city officials, on account of the fact that the sewer work can be handled with great speed and permits traffic to be kept open on main thoroughfares and makes for a neat, clean job, eliminating the piling of excavation on the side of the trench, or on abutting property, which invariably causes a lot of dissatisfaction where that is the practice.

Improved Sewage Ejector

The Chicago Pump Company, Chicago, Ill., calls attention to the following items which were recently brought out and have a use in the water works field.

First in importance is the Flush-Kleen sewage ejector. The important point about the Flush-Kleen sewage ejector is that it will discharge large and heavy materials. The submerged Flush-Kleen will pump successfully into the sewer, any sewage or foreign material which can run into a basin from sanitary lines. The Flush-Kleen sewage ejector has a self cleaning screen and rags, sticks and paper cannot clog the impeller because they do not come in contact with it. It is controlled by the Automatic Alternator which causes pumps to alternate their operation. First one pump takes up the work and then the second pump goes into operation while the first pump is at rest.



Flush-Kleen Sewage Ejector

A bulletin issued by the Chicago Pump Company goes into detail on all these points.

Second in importance to the water works field is the Non-Clog sewage ejector.

The Non-Clog like the Flush-Kleen, does not need a screen. It will pump heavy cumbersome materials and will pass wooden balls as large as 3⅝ in. in diameter. It will be observed that Non-Clog impeller will discharge any substance or objects which can pass into it.

The Non-Clogs are particularly adapted for lift stations in the smaller towns and municipalities.

The impeller has but two blades with carefully rounded edges. All water ways are smooth. There are no projections on which rags, strings or other material can catch.

It is keyed to the shaft and is held in place against shoulder on the shaft by a brass locknut.

High efficiencies are obtained over a wide range of capacities and heads due to very careful design and experience in pump building.

The Little Giant electric cellar drainer can be used to advantage in bilge and sump work where medium quantities of water are to be handled.

H-Section Fence Posts Announced

The Cyclone Fence Co., of Waukegan, Ill., announces the introduction of H-section posts for use with Chain Link fence guard.

In the past, fence builders have been dependent upon the use of standard shapes for posts and the fence built to adapt itself to the available shapes. The H column post is the first shape which has been designed particularly for use with Cyclone Chain Link fencing to insure maximum strength. A liberal margin of safety has been allowed in designing this post for the particular service which it must perform.

Its analysis, its measurements and its appearance have been agreed upon by both fence and steel research engineers after experiments carried on over a period of several years.

It is galvanized in Cyclone factories by the Cyclone Galv-After process and each post is embossed with the word Cyclone at four foot intervals.

It has a copper content of approximately .20 per cent.

C. H. & E. Sewage, Trash, Triplex Lift and Force Pumps

The C. H. & E. Manufacturing Co., Inc., Milwaukee, Wis., is now manufacturing a line of five sizes of sewage and trash pumps, powered by four cylinder engines from 15 to 45 h. p. through flexible coupling, with capacities from 400 gallons per minute at 50 ft. total head, to 2500 gallons per minute at 35 ft. total head.

These pumps are for the economical handling of fluids containing large solids and much foreign matter, particularly material of fibrous or stringy character such as is found in sewage. These pumps have two very definite advantages which greatly influence the efficiency and economy of operation; first, continuity of performance, without clogging; second, the elimination of the necessity and expense of screening out solid material in the fluids to be handled.

The impeller will pass anything that enters the suction nozzle, the pump being designed to handle solid spheres as large in diameter as the pipe size next smaller than that with which the suction connections to the pump are made.

In construction and drainage service they are used to great advantage where the water to be pumped contains rubbish, roots, sod, weeds or other objects which clog ordinary centrifugal pumps that have been tried unsuccessfully for trash pumping service.

These outfits are mounted on steel skids or steel trucks. Priming pump, clutch and all discharge fittings are standard equipment.

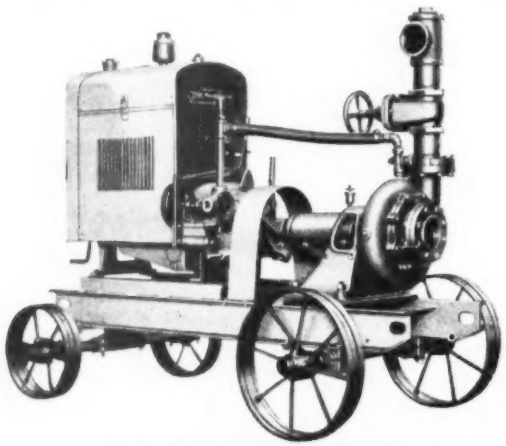
A new Triplex lift and force pump has been developed by the C. H. & E. Manufacturing Co., Inc., of Milwaukee, Wis.

This is a very sturdy, dependable outfit, designed to handle water carrying a large percentage of solid matter, and to force the water away from the job.

The outstanding features of this Triplex lift and force pump are a high suction lift, and self-priming, which eliminates constant attention.

Large metal valves are used, and there are large openings in the valve seats to allow solid matter to pass through. The suction and discharge valve cases and the water box are designed to allow the water to flow freely. The valves are very accessible, each valve having an individual cover held down by a clamp. The clamp is slotted on one end, which only necessitates the loosening of one nut a few turns to remove the clamp and valve cover.

This pump has machined cross-head guides which are lubricated from the plungers. Packing is not used as a quide for the plungers. The plungers are outside packed and easily accessible. Connecting rods are of the eccentric type, lubricated by individual sight feed oilers. The pump is driven by two machine cut gears of wide face. It will develop a 25-in. vacuum, and handle up to 100 well points, it is claimed, depending on the size of the points used and soil conditions.



C. H. & E. Sewage Trash Pump

Byers Announces New Process for Wrought Iron

The culmination of ten years' research work in the metallurgical field is reflected in the announcement of the A. M. Byers Company of Birmingham, Ala., at the American Water Works Association Convention of their new process for the manufacturing "Genuine Wrought Iron."

Briefly, the new process reproduces the same reactions that took place in the hand-puddling furnace, but with greater uniformity. Tests by leading metallurgists from Great Britain, Germany, and the leading railroads and petroleum interests of this country, indicate an iron with almost perfect slag distribution.

Pipe manufactured from the new material welds better, fabricates more easily and contains possibilities of being ultimately manufactured on a scale comparable with that of steel.

In the Byers new process, the definition of wrought iron, the temperatures and the chemical reactions which took place in the older processes have served as guides in working out several independent but definitely related steps. Above all, the principle is kept in mind for a composite material consisting of a refined base metal and slag. These two elements are therefore first produced separately and then mixed in such a manner as to produce a spongy ball which in all particulars, except in size, is identical with that obtained in a hand-puddling furnace.

The base metal refined may be carried out in slightly modified Bessemer, open hearth or electric furnaces. The pig iron is refined to an exceedingly low metalloid content, particularly with respect to carbon, silicon and manganese.

Slag is melted in standard types of furnaces from readily available raw materials, chiefly iron ore, roll scale and sand. The molten slag is an iron silicate conforming to the composition and characteristics of slag formed in the best hand-puddling practice.

The crux of the Byers new process lies in the so-called "shotting" operation. This operation consists in pouring the liquid metal which, as is well known, carries large amounts of gases in solution into a bath of molten slag. When the molten iron at a high temperature strikes the molten slag at a slightly lower temperature, there is, due to the sudden drop in temperature, almost instant solidification of the metal, and the gases are expelled with such a force that there are a million tiny explosions which have the effect of instantly disintegrating the metal as perfectly and uniformly as it may be observed to take place, though at a much lower, slower rate in a hand-puddling furnace.

The semi-solid globules of metal, owing to their high specific gravity, settle to the bottom of the slag bath, forming a spongy, porous mass of exactly the same composition as a puddle ball. In the heat interchange, hot metal naturally raises the temperature of the slag so that it remains liquid, thoroughly coating each globule as fast as it forms, and filling the interstices of the entire metallic mass.

From this point on, no change in the manufacture of the iron is made, except that the equipment is much larger and much heavier, due to the fact that the puddle ball is ten or more times larger than that produced in the former hand-puddling process.

Sweet Designs Fence Post

Sweet's Steel Co. of Williamsport, Pa., announce production of steel posts of flanged leg channel section. The posts have been designed from the results of research. The tests conducted were interpreted by the company in such a way that they eliminate ground plates.

Their posts are equipped with rivet lugs for holding fence or wires where desired. This method, the manufacturer states, of attaching fence to posts is exclusively a Sweet's feature. They state that by the rivet lug method the shearing of fence wire is reduced to a minimum.

Hand-Rotated Stopers

The Chicago Pneumatic Tool Co. of New York, have perfected their stopers and state that the CP-146W stoper (wet) combines high drilling speed, light weight, short overall length, ease of operation, low upkeep and effective and convenient air feed control for difficult drilling conditions. Being fully

CP-146W Stoper (wet)

cushioned and valve actuated, it does satisfactory work under poor conditions such as low air pressure, wet air and the added handicap of worn parts.

The main features incorporated in this drill can be summarized as:

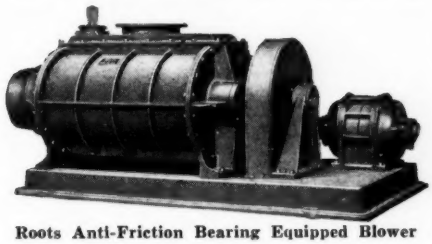
(1) Symmetrical balanced design—easy to operate.
(2) High drilling speed over a wide range of formations and conditions.
(3) Light weights.
(4) Four-bolt construction—gives ready accessibility to all working parts.
(5) Spring-retained front head.
(6) Fully cushioned, one-diameter piston—insures long life.
(7) Rugged, tubular valve, housed in renewable bushings in the cylinder wall, and piston-controlled exhaust—absolutely no tendency to "freeze" under the worst conditions.
(8) Effective, air-operated feed control, conveniently located in the rotation handle.
(9) Full 24-in. feed travel—facilitates steel changes.
(10) Air and water swivel connections conveniently located.
(11) Automatic lubrication.

Roots Blowers Now Use Anti-Friction Bearings

The P. H. & F. M. Roots Company, Connersville, Ind., originators, patentees and manufacturers of two-impeller rotary positive displacement units, announce the general adoption of anti-friction bearings for their blowers and Acme blowers.

The standard line of blowers carries Timken or SKF heavy duty roller bearings upon the purchasers' specification, and the Acme line of smaller units carries roller or ball bearings upon specification.

Constant research and construction work over a period of the past twenty years has convinced The P. H. & F. M. Roots Company, established 1859, that the manufacture of anti-friction bearings has now been perfected to the point where they recommend and use them.



Roots Anti-Friction Bearing Equipped Blower

A roller bearing has not merely been substituted for one of the adjustable babbitted type. The Roots Blower construction has been re-designed entirely, and changed to allow every additional operating advantage. Extreme care has been taken in designing the mounting. Complete protection from the entrance of foreign substances into the bearing housing has been afforded. Ample space is allowed around the bearing for a sufficient supply of lubricant, and provision is made for forcing the lubricant through the bearing from one side to the other.

In no case does the maximum load and speed of the bearing selected exceed one-third of the manufacturer's rating. Aside from the reduction in friction loss, Roots blowers with anti-friction bearings offer new possibilities for direct connection to smaller motors with less horsepower to obtain increased capacities, operate with higher efficiency by permitting the use of more closely fitting cases, permit greater capacities with conservative speeds, and deliver more volume with less horsepower.

Before the adoption of anti-friction bearings, The P. H. & F. M. Roots Company had listed 141 different applications of their products throughout all industry, and the change to the roller and ball constructions opens even a wider field for the use of rotary positive displacement blowers thus equipped.

Link-Belt Announces a Complete Line of Gasoline Locomotive Cranes

Even locomotive cranes are now driven by gasoline engines. Link-Belt Company, Chicago, Ill., has announced a complete line of locomotive cranes designed especially for gasoline engine, Diesel engine or electric motor drive, to be known as the L type cranes.

They are not merely modified steam cranes, but are designed throughout for the entirely different and much more severe conditions imposed by a power unit running continuously at its full operating speed.

The machinery and its arrangement are particularly adapted to direct engine or motor drive, and all clutches, brakes, shafts, bearings, gears, etc., are oversize in order to give the best operating results and the lowest possible maintenance expense, under these conditions.

The drive from engine or motor is a totally-enclosed silent chain drive, and all upper frame gears have machine cut teeth, cut from solid blanks. This makes a quiet, smooth operating machine.

It is furnished with two-speed travel gear to give a high travel speed for traveling light, and a slower travel

Link-Belt Locomotive Crane

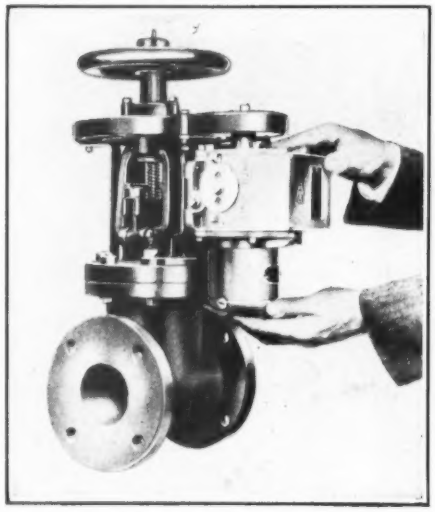
speed for pulling heavy loads or ascending comparatively steep grades. The two-speed travel gear in no wise affects the other speeds of the machine (hoisting, boom hoisting and rotating), which should, under all conditions, remain unchanged in order not to affect the operating speed and handling capacity of the machine.

The addition of the L-type crane in five sizes gives Link-Belt Company a complete line of gasoline, diesel, electric and steam locomotive cranes, and a line of heavy duty gasoline, diesel, or electric crawler shovels, cranes and draglines ranging from ¾ cu. yd. to 2 cu. yd. capacity.

New Motor Driven Mechanism for Operating Valves

A new motor driven valve operating unit has just been announced by The Cutler Hammer Mfg. Co., Milwaukee, Wis., which makes possible automatic operation of all valves up to 6 in.

Although so small that it can be held in one hand, this unique operating unit



Cutler-Hammer Motor Driven Valve Operating Mechanism

has a rating of 15 ft. lb. It can be operated automatically by means of float switches, temperature controlling devices, pressure regulators, etc., or by conveniently located push buttons.

Although only recently placed on the market this valve operating unit is similar in principal to the standard C-H Dean operating unit which has a successful record of 12 years.

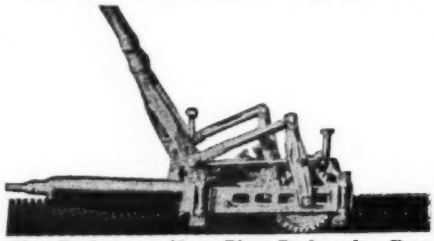
While designed primarily for valve operating service in industries where regulation of pressures and temperatures of gases and fluids is necessary, it is likewise adaptable to many miscellaneous applications, such as operating skylights, awnings, radiators, garage doors, etc.

Literature describing this new unit (called C-H type valve operating unit) will be sent free, upon request to The Cutler-Hammer Mfg. Co., 1298 St. Paul Avenue, Milwaukee, Wisconsin.

Improved Pipe Pusher

The Perfect size Easy pipe pusher was developed by the Easy Manufacturing Co., of Lincoln, Neb., to meet the demand for water companies for a powerful machine to push service pipes through the ground without digging trenches.

This new Perfect size machine is double geared and has two speeds so it



The Perfect, a New Pipe Pusher by Easy Manufacturing Co.

is rapid in ordinary work, yet when hard pushing is encountered or when large pipes are to be pushed, the machine can be put in low gear and in this way a greater pressure can be exerted. The machine is malleable and cast iron and drop forged steel. It is equipped with three pilots and will handle from ¾ to 2½ in. pipe. These pilots are all hollow so that water under city pressure can be put right up to the front end of them. In hard or dry soil this reduces the power required to push pipe at least one-half.

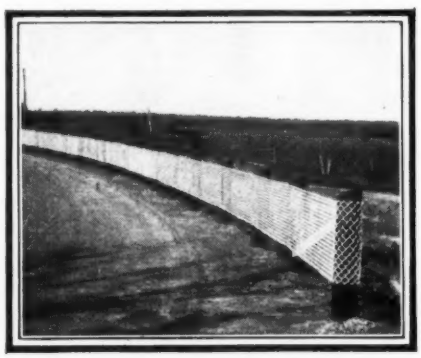
Following are specifications relative to the new Perfect:

Length of track 60 in. Weight of track 100 lb. Length of carriage 21 in. Width of carriage 15 in. Weight of carriage 125 lb. Shipping weight 280 lb. Double driving gears, double the power. Two speeds for different work and soils. In low speed, one man can push over 100 tons. In high speed he can push 40 to 100 feet per hour. Drop forged, heat treated vise jaws which positively hold the pipe. Machine is made of malleable iron, cast steel and rolled and drop forged steel. Handles ¾ to 2½-inch pipe.

New Use of Road Guard

The American Wire Fence Company of Libertyville, Ill., have developed new uses for American Life Net Guard.

An increasing number of municipal officials are finding it advantageous and advisable to protect properties such as parks, golf links, playgrounds and similar areas from promiscuous trespassing by automobiles. Such areas



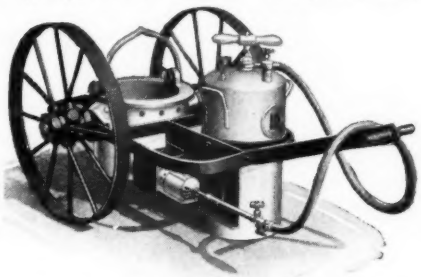
American Life Net Guard Prevents Road Encroaching on Municipal Golf Course

being primarily intended for recreation, automobiles not only damage the grounds but offer serious menace to life and limb.

An installation of American Life Net Road Guard as manufactured by the American Wire Fence Company protects such grounds from motor traffic but does not restrict pedestrians. The company will be glad to offer the aid of their experience along these lines to anyone asking for it.

Littleford Develops Lead Furnace

A new portable lead melting furnace, manufactured by Littleford Bros., Cincinnati, O., increases the efficiency of the pipe laying gang. Water works departments find that the torch-type oil burner not only melts lead very rapidly, but it can be easily detached



New Lead Melting Furnace by Littleford

and used to melt lead compound from old joints.

Littleford lead melting furnaces are made in 250, 350 and 450-lb. sizes. Both portable and stationary outfits are available.

Copper Service Pipe Developments

The past year, according to the American Brass Company, has witnessed a more widespread use of flexible copper service tubes with compression fittings for underground service lines for waterworks.

As rust constitutes a great menace to water distribution systems, one of the foremost requirements sought in pipe for service lines is corrosion-resistance, both internal and external. This, coupled with the need of strength, ductility and ease of installation, has brought about the increased demand for flexible copper service tubing.

Furnished customarily in straight lengths or coils, all the work required for an installation is easily done on the job. A hacksaw is suitable for cutting to any desired length. This tubing can be connected directly with the corporation stop without a gooseneck and easily bent to avoid underground obstructions. For casual bends, flexible copper service tubing may be worked cold by hand, and where a sharp bend is required a bending jig proves entirely satisfactory.

The freezing hazard, risk of pipe

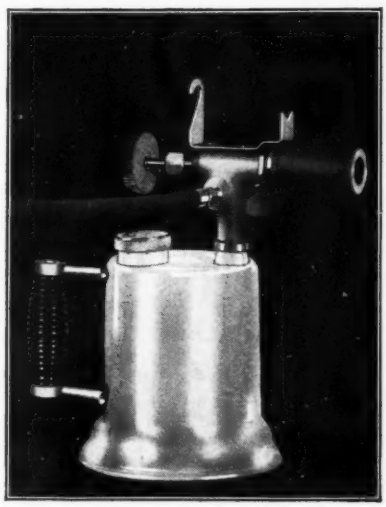
bursting from expansion in cold weather, is always a problem when ferrous service pipes are used. Strength and ductility render copper or copper alloys highly resistant to ill effects from freezing; the ductility will safely compensate for a change of as much as 15 per cent in the diameter of seamless copper tubes, it is claimed.

With modern street paving the costs incidental to replacing services installed beneath permanent highways is a serious consideration. Copper service tubes cannot rust, and consequently are not subject to stoppage because of rust accumulations. A smooth inner surface insures a clear, unrestricted flow at all times.

With a view to increasing the corrosion-resistance of this material, The American Brass Company, of New York, deoxidizes all seamless flexible copper service tubes. Smaller sizes of Anaconda tubing may be used with an ample margin of safety for working pressures up to 200 pounds. Detailed information regarding dimensions, physical properties, etc., of cold drawn copper tubes may be had by asking the above company for its publication C-9.

New Blow Torch Announced by Electric Sprayit Co.

The Sprayit blow torch, new in principle, design and construction, has just been announced by the Electric Sprayit Company, Inc., of South Bend, Ind. Due to the originality of its operation and design, there is no need to pump



Sprayit New Blow Torch

it, no priming and no preheating. A hot, blue working flame is instantaneously available for the job at hand simply by turning the valve and striking a match.

In addition to having the advantage of burning common kerosene instead of costly high test gasoline, the Sprayit blow torch actually produces 30 per cent more heat with the low priced fuel than others can produce with gasoline. As pumping and priming have been dispensed with, there is no chance to have dangerous fuels dripping from the torch. Due to a complete pressure break-up of the fuel, there is 100 per cent combustion and no carbon deposit.

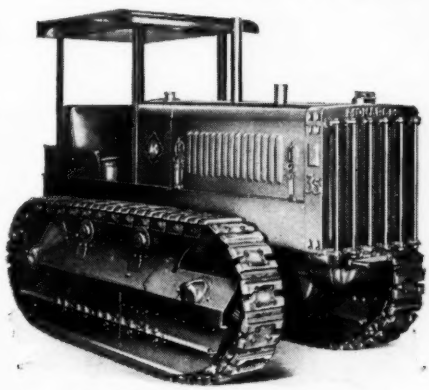
This new torch is so designed that it may be attached to any air supply. Hundreds of mechanics and tradesmen who need both a blow torch and a spraying outfit for their work, have found many distinct advantages in the Sprayit combination set, which consists of a complete electric Sprayit with compressed unit and the Sprayit blow torch which is interchangeable with the Agitator type electric Sprayit gun.

A New Allis-Chalmers Monarch Tractor

The Allis-Chalmers Manufacturing Company of Milwaukee, Wisconsin, announces a new track-type tractor for production and sales at their Springfield, Illinois, plant, the Monarch tractors division.

This new model is known as the Allis-Chalmers Monarch 35.

It offers a maximum of 36 drawbar



Allis-Chalmers New Monarch 35

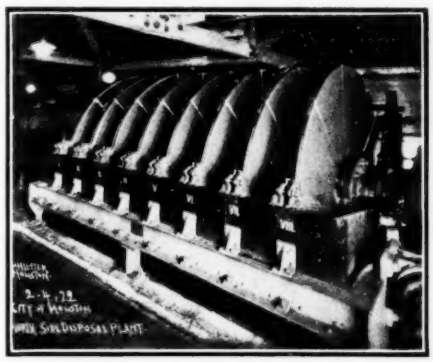
horsepower, three speeds forward and one reverse, 1.84, 2.75, 4.00 and 2.12 respectively. The engine is of a standard Allis-Chalmers type, designed and used exclusively for tractor work, and has four cylinders with removable sleeves set in the block, 4¾ in. bore, 6½ in. stroke. Motor speed under full load is 9.30 r. p. m., and is under governor control. Length over all, including starting crank, is 10 ft., 4 in., width overall is 5 ft. 2 in., height to top of radiator 5 ft. 1½ in. A full pressure lubricating system and an oil Pur-O-lator add considerably to its economical operation.

The track is of extra length as in the larger models, the 50 and 75, providing maximum traction ability, and an even distribution of weight. Features pertaining to the ease and facility of operation and the operator's comfort are incorporated in this machine. Steering is accomplished with a steering wheel and through steering clutches enabling the tractor to virtually turn in its own length. The Allis-Chalmers Monarch 35 is conservatively rated in accordance with the policy of the Allis-Chalmers Manufacturing Company in always maintaining an adequate reserve for peak loads. In general design, construction, and appearance, it is similar to the Allis-Chalmers Monarch 50 and 75 Tractors.

Activated Sludge Filters

The activated sludge process of sewage treatment still holds a strong position in the sewage disposal field and has been definitely adopted by a number of municipalities.

Continuous vacuum filters for de-



American Continuous Filter Installed at Houston Sewage Disposal Plant

watering the sludge formed have been continuously improved by the Oliver United Filters, Inc., of Chicago.

Activated sludge has proven a usable fertilizer, and, when recovered by filtration on continuous vacuum filters and subsequently drying to about 10 per cent moisture in rotary dryers, it has assisted in paying the cost of operating sewage disposal plants by those who have installed this system.

Recent improvements have developed a material increase in filter capacity over original results. A reduction of the moisture of the solid as discharged from the filter, and elimination—or at least a material reduction—in the tendency of the filter medium to become plugged and impervious to further filtration are results of improvements.

All of the above mentioned improvements are due to proper conditioning, control and mechanical handling of the activated sludge and have been demonstrated as being practical and obtainable by several plants.

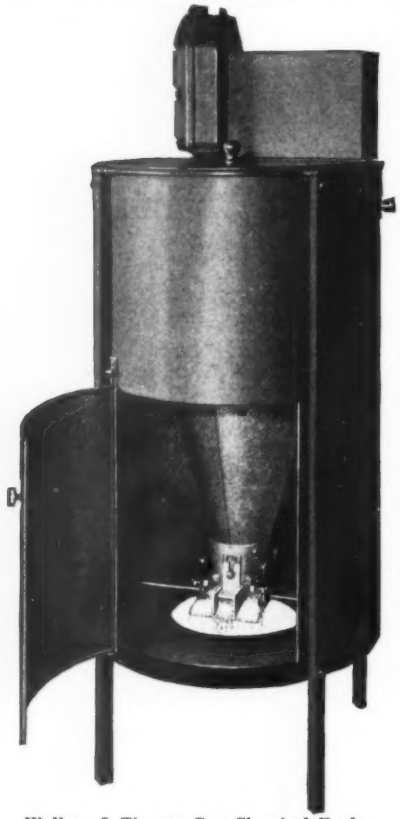
The city of Houston, Texas, using the activated sludge process, filters and dryers, is obtaining results more favorable than originally expected and is having no trouble marketing the fertilizer.

The sludge delivered to the filter at this plant averages around 99 per cent moisture and the solids as discharged from the filter about 77.5 per cent moisture. Capacity runs around 0.623 lb. per square foot of filter area per hour on the basis of 10 per cent moisture solid.

W & T Announces a New Chemical Feeder

Wallace & Tiernan Company, Inc., of Newark, N. J., have just announced their latest dry chemical feeder known as Type O. This feeder, which is the product of five years extensive study and research, has many novel features.

Designed essentially as a low capacity feeder, it has an unusually wide



Wallace & Tiernan Dry Chemical Feeder

operating range and may be used for either fine or relatively coarse chemicals. The minimum rate of feed averages 0.1 lb. per hour for all chemicals. The maximum varies from 40 to 80 lb. per hour, depending on the chemical handled.

Perhaps the most novel features of design are the flexing mechanism of the hopper, the oscillating spout and the convenient, accurate adjusting mechanism. The sides of the hopper are flexed by means of levers near the top which alternately pull in and push out the sides. This method of agitation positively prevents arching and keeps the contents of the hopper moving downward. A vertical agitator is provided for use with light chemicals.

The discharge from the oscillating spout is in the form of a ribbon and the rate of discharge is determined by the length of ribbon pushed off the feed plate at each stroke of the spout. The spout stroke is regulated by a hand wheel having a 100 division circular scale. This long scale, which makes two revolutions in covering the full feed range, makes adjustments easy and accurate. In addition to the spout stroke adjustment the cross section of the chemical ribbon may be varied.

The equipment is operated by a 1/6 hp. motor. The gear case is completely enclosed. The gears run in a bath of oil. Bearings exclusive of the gear case are fitted with special felt washers to keep oil in and dust out. The equipment is enclosed, and is thereby dustproof. It is adaptable for overhead feed with either direct or solution discharge to the point of application. When solution feed is desired a circular solution pot is provided. The water enters the pot at a tangent and the solution is discharged through a central overflow outlet. High velocity and violent agitation makes the chemical solution with a minimum of water. Baffles are provided to prevent flooding.

Bucyrus-Erie Announces D-2 Drag Shovel

The Bucyrus-Erie Company of South Milwaukee, Wis., have brought out a new drag shovel which they call their model D-2.

This machine is a diesel equipped unit which is the result of their 49 years of experience building excavating equipment. The diesel engine on this 1-yd. drag shovel is a 4-cycle, 4-cylinder engine with 6½ in. bore and 8½ in. stroke. It runs at 550 rpm. No priming and preheating is necessary according to the manufacturers. In starting they state, the engine is rotated from an air reservoir and, with the opening of a fuel valve, it delivers full power at once.

On the D-2 diesel drag shovel two of the outstanding features are the ruggedness of the front end and its extreme simplicity. Long life of cable is brought about by the fewest possible bends in the rope and good-sized sheaves. Fewer sheaves mean greater power for actual digging and faster overhauling of cables—a faster cycle.

Bucyrus-Erie New D-2 Drag Shovel

D-2 drag shovel dipper is built with a heavy extra arch. It takes the thrust of the boom and dipper handle and gets away from the spreading of the dipper that causes delays with ordinary dipper construction.

The long chisel-shaped reversible teeth are held without bolts or rivets in wedge-shaped sockets. This tooth is easy to sharpen and replace.

Fundom Shovel Improved

The Fundom Hoist & Shovel Company of Lima, Ohio, have developed their machine now to the point where it serves as dragline, crane, clamshell, shovel and trench hoe. The 12-ft. boom is constructed of 8-in. channels reinforced with plates and ties. The crowding mechanism is operated by double-pad special lined clutch, driving

Fundom Shovel on Road Grading Job

link chain to support shaft, which is provided with two steel, machine cut, pinions meshing with steel, machine cut, rack on dipper handle.

The machine is powered by a Fordson tractor or electric motor. It travels at 2½ mi. per hr. on treads which are 9 ft. 6 in. long, equipped with Alemite lubricating system.

The boom travels ¾ circle, traversed by worm and worm gear driven sprocket meshing with a stationary link chain provided with a shock absorber. Dipper is 1/3 cu. yd. capacity.

King F. P. Water Meter Improved

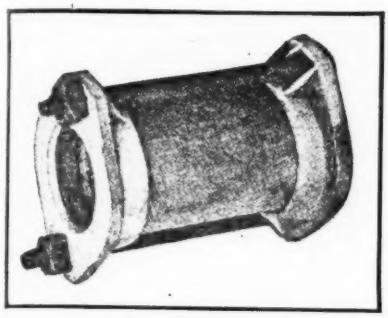
Union Water Meter Company of Worcester, Mass., recently celebrated the sixtieth anniversary of its incorporation by producing the King F. P. (frost protected) meter, which experts agree overcomes former weaknesses in design and construction.

Among the marked advances of this new meter which users of meters will immediately recognize are the position of the thrust roller, an eccentric which locks the disc chamber in place and the use of monel metal pins and lock screws which yield to excessive pressure, such as frost.

The same type of meter is also being produced with split case and is known as King S. C. meter.

Snell Improves Easy-On Threadless Pipe Couplings

The George H. Snell Company, Attleboro, Mass., announces that they are now making their line of couplings and tees of heavier construction throughout. Stronger ends combined with seamless

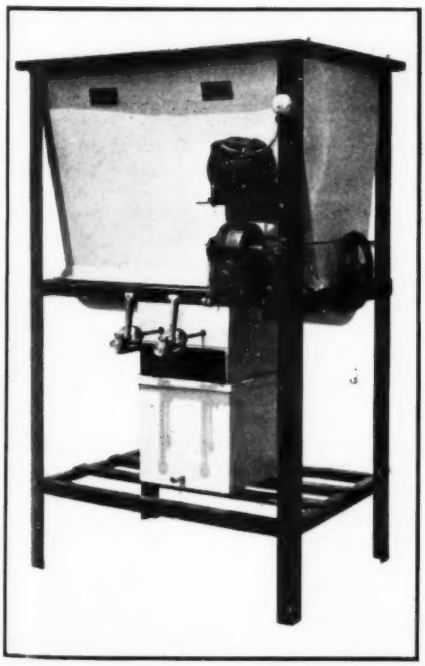


Snell Easy-On Threadless Pipe Coupling

steel tubing enables them to guarantee this new coupling to stand the strain of 250 lb. pressure. Especially recommended for repairing breaks, and making meter connections. Descriptive literature will be sent on request.

Multiple Type Dry Chemical Feed Machine

It has heretofore been necessary to install a separate dry chemical feed machine for each chemical used in a water purification plant. E. W. Bacharach & Company of Kansas City, Mo., have recently placed on the market a multiple type dry chemical feed machine that involves entirely new patented principles of operation. This device



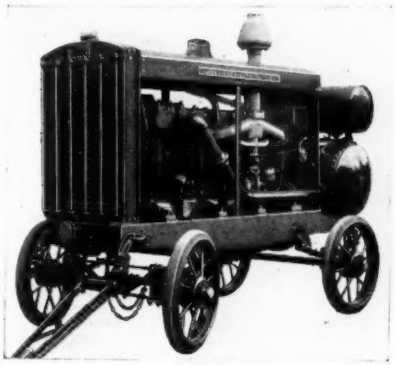
Bacharach Machine for Feeding Two Chemicals

will accurately feed any number of dry chemicals simultaneously in the same or in different amounts. The machine may also be used to feed several different amounts of the same chemical to separate points of application. The same principle of construction is carried out in building a machine for feeding three or more chemicals.

Some of the advantages of installing a single unit machine that will do the work of a number of individual devices are reduced initial cost of apparatus, decreased installation expense, saving of space and power, and less repairs and depreciation. The multiple machine may be calibrated and regulated in the same time that it takes to perform these operations on a single feed machine. The multiple feed machine is especially adaptable for use in small and medium sized water purification plants.

New Air Compressor Developed by Independent Pneumatic Tool Co.

The Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago, Ill., has developed a complete line of com-



New Thor 250 Ft. Portable Compressor

pressors and contractors' pneumatic tools.

Their new unit is a Thor 250-ft. portable air compressor which, under actual test, it is claimed, delivers 210 cu. ft. of air per minute. It is equipped with the patented Rix super-charger, which enables the piston on its idle or downward stroke to compress the additional air the Thor delivers.

The Thor is direct driven. It has no clutches, couplings or gears. This design makes for simplicity and low upkeep cost. The compressor is low slung and well balanced. All working parts are easily accessible.

The bore is 7½ in. and the stroke is 7 in. The length overall is 10 ft. 10½ in. Height overall is 6 ft. 4¾ in. Width is 4 ft. The Thor compressor can be had in a variety of mountings to suit individual requirements.

The Thor 116-ft. portable air compressor, which delivers 96 cu. ft. of air per minute, will also be shown. The design and construction is similar to the larger unit.

The company's line of contractors' pneumatic tools consists of paving breakers, clay diggers, sheeting drivers, back-fill tampers, riveting hammers and chipping and calking hammers.

Littleford Bros. Announce New Tool Box

Littleford Bros., Cincinnati, O., are manufacturing an all-steel utility service tool box for public service companies and water works departments.

Littleford Utility Tool Box

They stress the safety, convenience and trailing qualities of this box.

Dimensions are: 54⅛ in. long, 36 in. wide and 36½ in. deep. The double cover can be raised from either side —it is flanged down on all sides and is absolutely waterproof. Under the cover is a large double tray for small tools. About halfway down the main section of the box is a shelf 12 in. wide and 54⅛ in. long. The side walls of the box, when opened out, form strong utility shelves.

Strong, low slung chassis cushioned on heavy helical springs, 32 in. by 3 in. rubber tired wheels equipped with heavy duty roller bearings, 1½ in. high carbon steel axle and non-collapsible drop leg are assurances of long, steady service under hard usage.

Littleford Bros., also make a large heavy duty all-steel tool box for public service and highway maintenance work. An all-steel storage box made in two sizes complete their line of tool boxes.

Light Steel Sheet Piling Devised

Wemlinger, Inc. of New York have developed a corrugated sheet pile of light weight steel which is interlocking and easily handled.

With the protection of a driving cap the sheeting may be driven by hand, air or steam without being damaged, so that it can be used repeatedly

Withdrawing Wemlinger corrugated sheeting is as simple and economical as driving it. Its light weight makes unnecessary expensive equipment and high labor costs. The sections, made interlocking by short clips, are separated without damage as easily as they are put together.

Improved Non-Clogging Centrifugal Pumps

In the last few years rapid development of centrifugal pumps for handling domestic and industrial sewage has been made by a number of manufacturers. The satisfactory handling of sewage of all kinds requires that the pump be capable of passing rags, sticks, stones, etc., without clogging and without the use of strainers. Originally it was thought that this could not be done without sacrificing efficiency. Experimentation, however, has shown that non-clogging pumps can be made to approach in performance and dependability the better clear-water pumps.

In this class of apparatus the Economy Pumping Machinery Company, Chicago, Ill., has announced three new non-clogging designs containing numerous mechanical improvements that make for longer life. These new pumps are made in capacities from the 3-in., 100 gpm. unit that will handle 2½-in. spheres to the 10 in. 5,000 gpm. pump that will pass 7-in. spheres. Pumps of all capacities are made in vertical submerged design, vertical open-shaft design, and horizontal direct-connected or belt-driven.

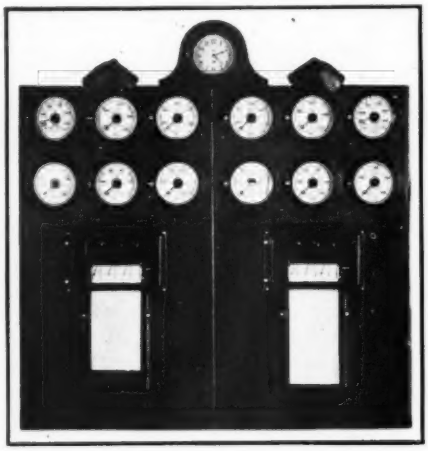
The vertical submerged type is used principally for handling sewage in buildings and industrial establishments where a self-contained unit is desired. The adaption of the non-clogging design to this type of apparatus presented a difficulty in that the impeller hub must be long enough to lock it to the shaft and to receive the countersunk nut. In the new construction the impeller hub is covered with a steel sleeve that acts as the lower journal, making it possible to extend the lower bearing close to the impeller, thus increasing the bearing life and removing all journal wear from the pump shaft. The bearing at the upper end of the shaft is a combination radial and thrust ball bearing mounted in a dustproof housing with double-nut micrometer adjustment. This adjustment makes it possible to drop the impeller assembly to compensate for wear at the impeller inlet.

The open-shaft vertical pump is designed for installation in dry pump chambers such as usually are provided in municipal sewage plants. Instead of operating in the liquid to be pumped, suction pipes are connected to a wet well or chamber. With this type of installation it is possible to elaborate somewhat on the pump design. These open-shaft pumps are of the ball-bearing type with all running bearings above the pump case in a tight grease-lubricated housing. There is provided in the shell a short renewable bearing that is used to take any shock that might occur should a brick or other heavy solid become lodged in the impeller. Adjustment of the impeller is accomplished by means of a micrometer adjusting nut at the upper ball bearing. This adjustment may be made by lifting the bearing cap without removing the coupling from the shaft.

Horizontal pumps of the non-clogging design are used for handling sewage, foodstuffs, paper stock and any other stringy or pulpy material. These pumps may be direct motor driven or belt or chain driven from any suitable power source. They are of rigid design with roller outboard bearings that carry the entire weight of the rotor, there being only a shock bearing within the pump casing.

New Control Panel Announced

The Republic Flow Meters Co. of Chicago announce their new type Republic master panel. This panel makes possible the centralized control of all pumping and storage units, regardless of their location. All records are grouped on the master panel, giving a



Republic Flow Meter Master Panel

complete survey of the operation of all hydraulic units.

Indicating, integrating and recording units can be mounted in any desired combination which will best meet the individual requirements of the installation.

Pipe Line Welder Improved

A pipe line from Jal, N. M., to El Paso, Tex., is being constructed entirely by welding, employing the metallic arc. The pipe itself is fabricated by this method in the plant of the A. O. Smith Corporation in Milwaukee and the line also employs their recently announced Smith Welded expansion joints.

In construction the 30-ft. lengths of pipe are first joined into sections of 5 to 8 lengths, usually 7, by tack welding and are then welded by "the firing line welders," the pipe being turned by tongs as the welding operation progresses. "Firing line" welders are averaging 13 completed welds per 10 hours, it is said. The sections are then

Fuson Welder Moving to New Setup

joined "by the bell hole method," in which a hole is dug for the welder, and he works completely around the pipe as it rests stationary over the ditch.

General Electric, Lincoln and Fuzon welders are on the line. This latter machine is a mobile outfit, being mounted on pneumatic tires, with standard Ford wheels.

The rod being used is the Green Surface Weldite, a product of the Fusion Welding Corporation of Chicago, as is also the Fuzon welder.

Hydraulic Power Electrolyzer Announced

The Direct Oxidation Process Corporation of Philadelphia, Penn., has recently placed on the market a new design of electrolyzer utilizing hydraulic power for the operation of the scrapers. This new arrangement superseded the previous crank and connecting rod type of drive and makes it possible to use larger, and in consequence a less number of electrode plates with a corresponding longer scraper travel resulting in a reduction of about eighty per cent of the moving parts required in former designs. The drive is conveniently mounted above the electrolyzer tank thus eliminating the extra excavation required with the previous models in which the scraper operating machinery was located under the tank. In addition, due to the more compact arrangement, the required length of the equipment for a given treatment capacity is materially reduced resulting in large savings in building costs. The design, in general, greatly increases the accessibility of the interior of the machine, facilitating maintenance and inspection.

Masterwrench Announced

Heller Brothers Co. of Newark, N. J., announce to the field a new wrench that automatically fits all sizes of pipe, bolts and nuts. They call it the Masterwrench. Every Masterwrench is made from carefully heat treated drop-forged, chrome vanadium steel. Its two parts rapidly adjust themselves to the size of the job at hand. It is self adjustable.

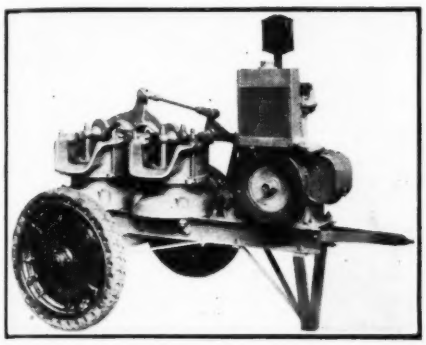
A New Double Diaphragm Pump Unit

The John Lauson Mfg. Co., New Holstein, Wis., announce a new double diaphragm three inch pump unit. A 2½ to 3 h. p. Lauson vertical radiator cooled engine furnishes the power.

Some of the features of this engine are:

Mechanically driven flyball governor enclosed in dust proof housing.

Roller bearing construction; the crankshaft is mounted in high grade heavy duty roller bearings which are lubricated from engine crankcase. This construction reduces friction and promotes smoother performance.



Lauson Portable Double Diaphragm Pump

Heavy counter-balanced crankshaft; the crankshaft is 1⅜ in. in diameter, balanced with counter weights which reduce vibration to the minimum. A good heavy crankshaft is the backbone of an engine. Heat treated, drop-forged shaft of more than ample proportions is used in this Lauson motor.

Cam shaft; the camshaft is one piece, drop-forged, hardened and ground, and is mounted in large bronze bearings. This type of camshaft will show very little wear and will maintain correct valve action.

Oiling system; the lower base of engine forms an oil reservoir from which the oil is raised by a submerged plunger pump driven by an eccentric on the camshaft. The oil is distributed to all vital parts of engine by splash system.

Connecting rod; the connecting rod is interchangeable with Ford Model T rods.

Piston; the grey iron piston, specially designed for high speed performance is equipped with three rings.

Ignition system; high tension Wico magneto.

Hutto ground cylinder; the Huttto Method of grinding is used by 85 per cent of auto and airplane engine builders, because it positively produces a straight and round bore within tolerance limits of .0005 in. in regular production.

The units will be furnished with any of the leading makes of diaphragm pumps, mounted on two wheel cushion tire trailer or four steel wheel trucks. They will be available for distribution about June 20th.

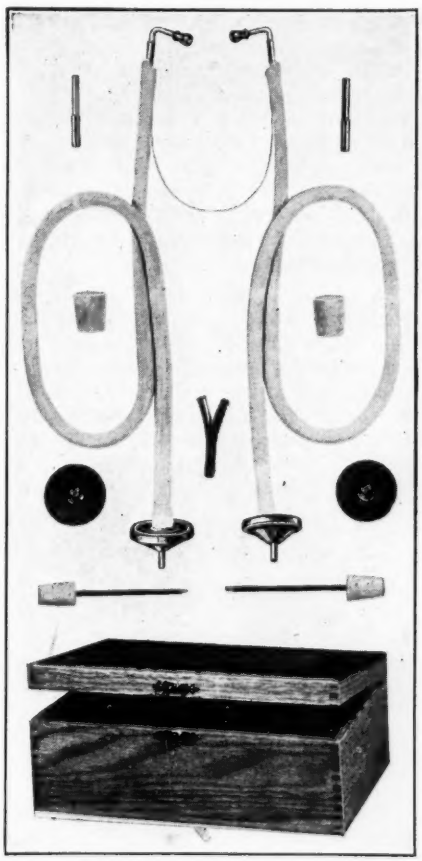
They are compact construction weighing only 775 pounds complete. The engine has a built-in gear reduction. One set of gears, which are carefully guarded operate the jack, which is of the walking beam type.

Sound Locating Tool

A new, improved Twin model Transmit-O-Phone has been developed to assist engineers, operators and mechanics in quickly and economically locating defects in all classes of mechanical devices, pipe lines, and machinery. It is manufactured by the International Metal & Specialty Co. of Berlin, N. J.

The Transmit-O-Phone is not designed to fix anything or to run a Power plant; and like any other high-class tool it naturally takes a little practice for the operator or mechanic to become proficient in its uses. It is exceedingly simple and if used with a little intelligence, the average individual can become very proficient in quickly and accurately locating defects by sound.

Use the corks on the small rods screwed into the point of each amplifier for testing fast moving machinery; where more amplification is desired, use the small round plates screwed into point of each amplifier. The corks on rods are used for clarifying the sounds in high-speed machinery.

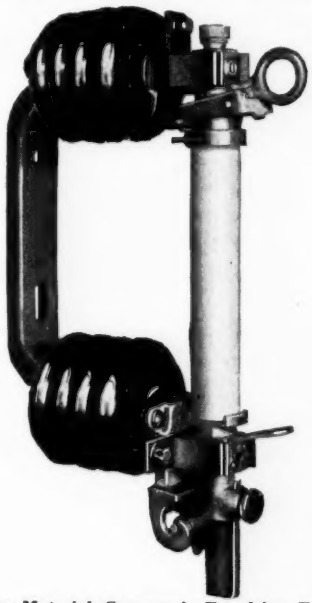


Transmit-O-Phone for Locating Defects

Should there be any problem which the operator or user of the Transmit-O-Phone may not quite understand, no matter what it may be, pipe lines, power plant machinery, motors and gears, etc., if they will drop a few lines to our main office we will be only too glad to have our engineers help them to solve their problem.

Locked Cartridge Expulsion Fuse

The Line Material Company, South Milwaukee, Wis., has brought out a new 15,000 volt, 150 ampere outdoor expulsion fuse known as their locked cartridge type. The fuse derives its name from the fact that the cartridge cannot be blown out of the contact clips under heavy short circuit conditions.



Line Material Company's Expulsion Fuse

The type ED6-15M1 shown in the illustration has the lower casting arranged as a pivoted hinge for the cartridge and is so designed as to prevent the square lower terminal on the fuse cartridge from moving away from the contact clips. The cartridge is securely locked in the closed position by means of a positive catch just below the top contact clip. The catch is held by means of a bronze spring and cannot be disengaged except by pulling the ring handle downward. The top cartridge terminal is equipped with a knurled cap and the lower one cast with a guiding fin and equipped with knurled contact screw. A small L-shaped projection is fastened to the lower square terminal block on the cartridge for use in connection with a combination lift and pull stick.

The contacts are spaced on 12-in. centers, are double spring clip type, insuring ample and uniformly distributed pressure. The top contact clips are the full floating type, insuring proper alignment at all times.

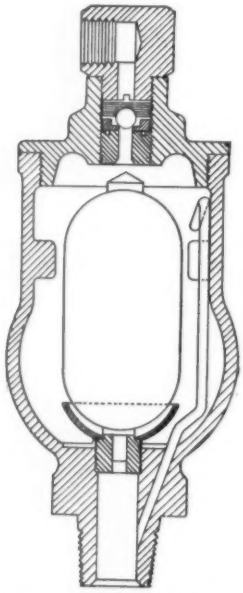
The U-shaped mounting is of galvanized malleable iron and has, it is claimed, a 20,000-volt one piece insulator at each end cemented thereon and allowed to set under steam, insuring a perfect bond.

The cartridge tube is furnished either of bakelite or fiber. The bakelite tube is provided with a special high heat resisting lining which by a special process is made an integral part of the tube. The tubes can also be furnished with an outer porcelain tube for protection from the weather. Fiber tubes are always furnished with the porcelain outer tube. These fuses are described in the company's new catalog No. 28-A.

Apco Automatic Air Relief Valve Improved

Within the last few months a new and improved automatic air relief valve has been brought out by the Automatic Primer Company, Chicago, makers of Apco Primers for centrifugal pumps.

This new air relief valve has proved useful in three different applications, namely, to centrifugal pumps, piping systems and various types of tanks or vessels. The valve is a simple device



Apco Automatic Air Relief Valve with Ball Inserted

which passes air in or out but closes immediately on liquids.

On centrifugal pumps, single or multi-stage, the valve automatically vents the pump casing of air which if not removed would prevent the pump from picking up its load. In large pumping systems where the several pump casings are connected to a vacuum tank, the insertion of an Apco air relief valve between each pump and the vacuum tank will prevent any liquid being taken over when air is evacuated from the pumps and suction lines.

The function of the valve on pipe lines in buildings or on cross country lines is to vent air from such lines whenever summits occur since air pocketed at these high points will otherwise lower the capacity of the line or even entirely block the flow of liquid. The valve serves certain types of fluid tanks and vessels in the same manner.

The Apco air relief valve is constructed of nickel plated cast bronze with a non-collapsible copper float. It is made in 3 sizes adapted to the majority of conditions. For further information on operation of this unit, write to Mr. Bradford, Automatic Primer Co., Chicago, Ill.

Agitator Drives in the Water Works Field

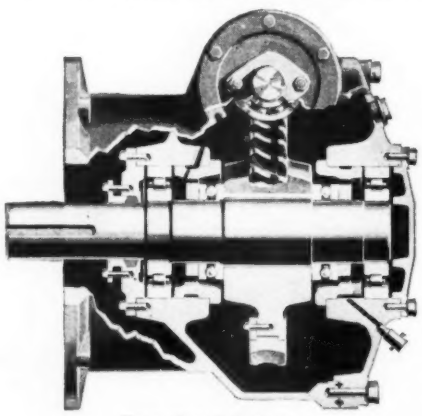
The Agitator drive speed reducing unit has found favor in filtration plants, sewage disposal plants, water purification plants and many other places where the introduction of some form of speed reducing equipment is required.

To meet these growing demands for a compact enclosed unit drive for operating mixers, agitators, paddles, etc., Foote Bros. Gear & Machine Company of Chicago, has added a complete line of vertical worm gear speed reducers. These worm reducers of the vertical type are made in two different types, either the type W commercial worm or the Hygrade worm reducer.

I X L speed reducers are fully enclosed, self-lubricating and dust-proof. Because there are no exposed moving parts they are safe. They conserve space and improve working conditions.

The vertical speed reducer of either the W or Hygrade type permit the use of standard speed motors which are less expensive than vertical slow speed motors and makeshift combinations of gears, chains or pulleys, according to the manufacturer.

The vertical worm gear speed reducers are similar to the Standard horizontal type reducer, except that a flange base is provided so that the vertical reducer is designed to lay on its side with the driving shaft at the right, the worm gear revolves in the horizontal plane and the slow speed shaft is in a vertical position. This shaft can be extended upward or downward, as the conditions may require, so that the reducer can be located under or above the machine to be driven.



Foote Speed Reducer

The construction of these reducers is similar to the Standard type reducer embodying a cast iron case, treated to prevent flaking, with a removable top cover.

Removable end plugs with oil tight stuffing glands and oil seals at each end of the worm. The base is cast integral with the case to provide suitable mounting either on the floor or hanging from the ceiling.

The worm is made of a high grade alloy steel, carbonized, hardened, ground and polished. The worm gear can be furnished either of semi-steel or bronze. Bronze is recommended by the manufacturer because of lower coefficient of friction with less heating losses and longer life.

These machines, either the Standard type W or the Hygrade type, are fully enclosed, self-lubricating units, that require little attention, except the occasional replacement of the oil.

Ball thrust bearings are provided at each end of the shaft to take up any upward or downward thrust. They are compact, noiseless, efficient, dependable units; built to meet every modern agitator problem.

Rawhide Packing for Water Works Use

This is an opportune time to call the attention of the superintendents and water works engineers to the advantages of using Rawhide packing on their pumps, both centrifugal and reciprocating, and their valve stems in all lines of work.

How Mabbs Rawhide Packing Is Shipped

A great many do not appreciate the advantages of Rawhide packing for water works use. Rawhide packing is nearly anti-frictional and its great advantage is that it is too soft, when saturated, to hold the particles of grit upon its surface, but they work back into the body of the packing, thus preserving the metal surfaces from wear and cutting. The manufacturers of

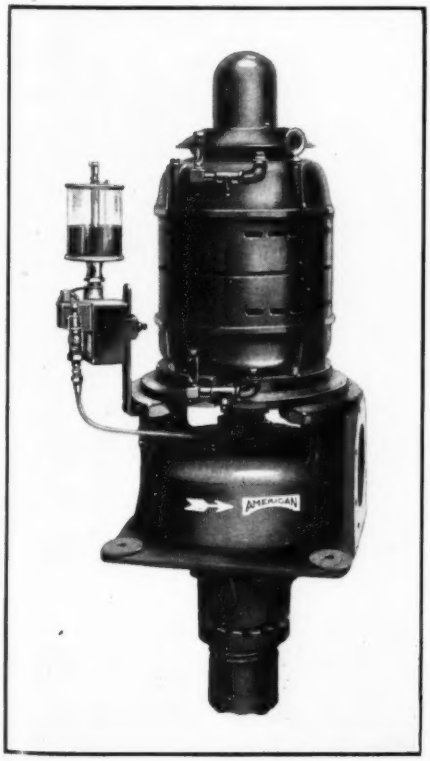
this packing claim there is nothing equal to their Rawhide packing for handling raw water or water where there is any sediment or sand in it. It is claimed that this packing has been used for twenty years by the United States Government on their hydraulic dredges.

Another comparatively recent line which has been brought out by the Mabbs Hydraulic Packing Company of Chicago, is their line of Rawhide meter washers for packing the stems of any kind of water meters. There Rawhide washers are claimed to be superior to cork washers that have been extensively used in the past. The advantages claimed by the manufacturer of these washers are that they are practically anti-frictional and never become hard or glazed and will last for years.

Small Bore Well Turbines Developed

The American Well Works announces their new 6-in. and 8-in. deep well turbines. These turbines have been built in response to a demand for a turbine to fit smaller bored wells. The deep well turbine consists of the turbine head proper, which is the driving unit, the supporting pipe, which encloses the driving shaft, and the turbine itself, which consists of the number of stages necessary for the specific requirements.

The turbine head consists of the vertical motor mounted on a rigid and compact base. The thrust bearing of the motor is designed to carry the load of the line shaft and impellers.



American Deep Well Pump

To the turbine is attached the supporting pipe, to the lower end of which is attached the turbine proper.

The turbine proper is a special style of the turbine type of centrifugal and is designed with the special features that have made American deep well turbines so reliable and efficient.

All bearings are oil lubricated by gravity feed from the surface, the gravity feed being electrically controlled.

Provision is made for complete drainage of all waste oil and water leakage and the discharge pipe is located above the floor level, which permits of easy access.

Engineering data and construction details of these turbines may be had from the engineering department of the American Well Works, Aurora, Ill.

Portable Test Meter Announced

A new portable test meter has recently been put on the market by the Badger Meter Manufacturing Company,

New Test Meter by Badger

manufacturers of water meters, Milwaukee, Wis.

This new portable test meter was developed in the engineering laboratories of this company.

The Badger portable test meter is a complete and self-contained unit of light weight, making it possible to be handled and operated by one man and with the connections set up in a practical way which permits of attachment to the service meter or when testing from hose pits in a very limited time. It will consistently and accurately check a given amount of water passing through the service meter, indicating the error either plus or minus, slow or fast on the service meter.

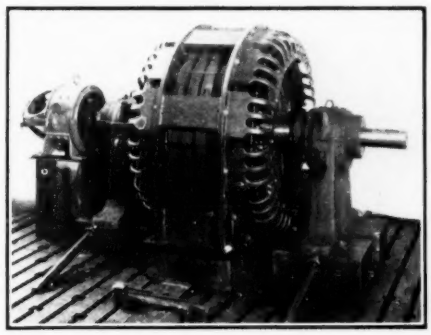
This new portable test meter makes it possible for all meter services to be checked regularly and thereby effect big economies and increased revenue, due to the increased efficiency on the service meters.

This portable test meter is a tried and proved product and has been put on the market only after years of experimental and research work in the Badger Meter Engineering Laboratory.

Structurally Fabricated Motors Announced

Fabricated steel, first used in the construction of low speed synchronous motors, is being extended rapidly by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., into the high speed motors and vertical low speed motors generally used for water works pumps.

This new type of construction is particularly well adapted to building large units. A mechanical design of known and maximum strength can be produced and the construction is such that effective radial ventilation can be obtained.



Westinghouse 600 hp., 1,200 rpm. Motor for Mounting on Pump Bed Plate

Laminations are securely held between the end plates by through bolts. The end plates are further supported by struts welded between them and supporting fingers prevent loose and noisy laminations.

The advantages of adjustable speed drive and the synchronous motor high efficiencies have been secured, to a great extent, in the two-speed synchronous motor. This consists essentially of two standard synchronous motors of different speeds mounted on the same shaft and each with its own control equipment, electrically interlocked so that either unit may be operated depending upon the speed desired. The control is also arranged so that it is impossible to connect both units to the line at the same time.

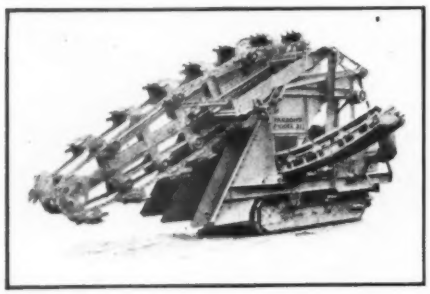
Another interesting development is the use of the reduction gears with both single speed and two-speed synchronous motors to secure the less expensive and higher efficiency high speed motor. The total cost per motor and gear unit is usually equal to or less than for the low speed motor only, and the efficiency of the unit, including gear loss, is as good or higher than for the low speed unit.

A further development has been the mounting of the synchronous motor on the extension of the gear unit pinion shaft. This method uses the engine type motor with the motor rotor overhung, tends to simplify the unit, reduce floor space required for mounting and makes the motor readily accessible.

Parsons Improves Excavator

The Parsons Company of Newton, Iowa, give the following relative to their trench excavator:

All of the main mechanism is enclosed in one gear case, gears being machine cut and case hardened. The



Parsons New Model 31 Excavator

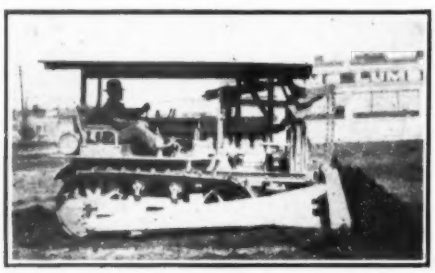
shafting is turned and ground, mounted on anti-friction bearings, both of the roller and ball type. All gears run in an oil bath. The traction drive gears are also enclosed in an oil tight gear case. It is the highest type of construction known in the manufacturing field. It reduces the amount of friction loss as well as reducing the amount of wear and tear on the machine.

When the first machine was built it was put on actual construction work and has already gone through a grueling test period.

Ateco Hydraulic Bulldozer

The Ateco hydraulic bulldozer, recently announced by the American Tractor Equipment Company, is constructed of steel throughout, electrically welded and sturdy enough in all parts to withstand without damage the full pushing power of the tractor.

The Ateco hydraulic bulldozer consists of a heavily reinforced bowl, or blade, extending across in front of the tractor and connected to the tractor trucks through heavy, box-section side arms, one on each side of the tractor, which pivot on pin brackets attached on the outer sides of the tractor truck frames at a point where the rise and fall of the treads when working over rough ground will least affect the position of the blade. A structural steel framework is attached to the tractor through already existing bolt holes which supports at its front end a bell



Tractor Equipped With Ateco Bulldozer

crank assembly. This is connected to the blade through chains, and a hydraulic cylinder with piston rod attached to the central arm of the bell crank for raising and lowering the blade through hydraulic power secured from a pump driven by the power take-off shaft of the tractor through a special 4-way valve.

The hydraulic control of the Ateco bulldozer permits the driver of the tractor to accurately raise or lower the blade instantly by means of one control lever located just in front of his seat, in the same manner that the hydraulic hoist on a dump truck is operated.

There are no parts of the Ateco hydraulic bulldozer that in any way interfere with the drawbar of the tractor; in fact, the Ateco bulldozer is frequently used in conjunction with the Ateco hydraulic dirtmover, both bulldozer and dirtmover being attached to the one tractor at the same time. When it is desired to remove the Ateco bulldozer to use the tractor for other purposes, this can be done in a few minutes by pulling the two pins locking the side arms on to the pin brackets and taking two clevis pins out of the chain links connecting the blade to the crank assembly at the front of the tractor.

The Ateco hydraulic bulldozers are manufactured by the American Tractor Equipment Company of Oakland, Calif., recently organized to build bulldozers and dirtmovers manufactured under the McMillan Patents, over 150 of which are now in use.

Trackson Announces Bulldozer

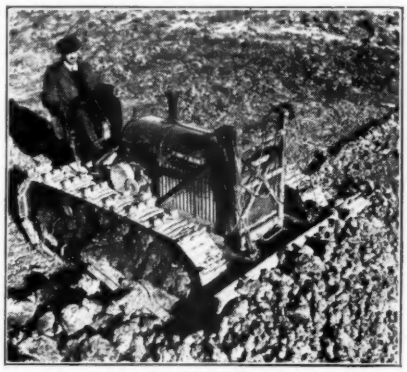
Power, speed and economy for dirt moving operations are provided by the new Trackson bulldozer, which is a recent addition to tractor equipment.

This bulldozer is manufactured by the Trackson Co., Milwaukee, Wis. It is designed especially for mounting on the Model DH Trackson McCormick-Deering crawler tractor, providing an efficient, economical unit for back-filling sewer trenches, ditches, etc., and many other similar jobs.

Like all other Trackson equipment, the bulldozer is built for heavy duty, and its extraordinary strength guarantees day-after-day reliability. The blade is mounted in such a way that the thrust or push is taken by the crawler frame, eliminating undue strains on the tractor.

The mechanical hoist used in the Trackson shovel, loader and crane is also incorporated in the Trackson bulldozer. The same principle is used in most big shovels, loading and lifting machines, a fact which attests to the efficiency of this hoisting arrangement.

This similarity of the hoisting assemblies and frames of all Trackson front-end attachments permits the ready interchangeability of these machines, which is an important advantage in that it enables the owner to use the same power unit for many different jobs. For instance, when the Trackson bulldozer has been used for backfilling a trench, the bulldozer may be removed from the tractor and the loader or shovel mounted in its place.

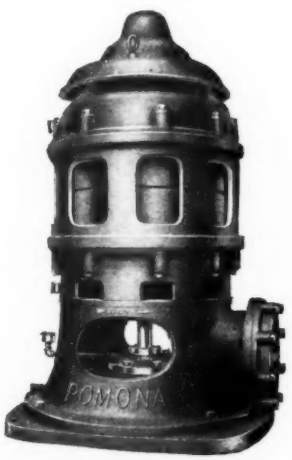


New Trackson Bulldozer

The Trackson crane is another important tractor attachment which is a time and labor-saver for water works and other public works departments. It may be used for unloading or carrying pipe, and for lifting and transporting heavy weights of all kinds.

Pomona Utilizes Water Lubrication

The Pomona water-lubricated superturbine pump, manufactured by the Pomona Pump Company, Pomona, Calif., has developed one type of turbine pump which, it is said, is especially desirable for city or municipal use because it is lubricated by water in



Pomona Westinghouse Unidrive

the well. This method of lubrication eliminates the use of all oil or grease below the surface, thus preventing contamination of the water. In addition to providing uncontaminated water, this method of lubrication forms a protective film that makes the bearings practically indestructible and prevents frequent pump troubles, officials say. Pomona pumps occupy little space, re-

quire no pit, are noiseless and vibrationless—all advantages which make these pumps especially suited to municipal use, the manufacturers believe.

Where it is desired to pump water from the well into tanks or reservoirs, it can be done quickly and economically with Pomona turbine pumps, it is stated. Water can also be delivered direct into mains under pressure; or direct into a pressure tank by automatic control, making it unnecessary for an operator to start or stop the pump.

To provide Pomona pumps for practically any conditions of pumping, the manufacturers have made them available in a variety of sizes and capacities and with either motor or belt drive. The type most widely used is the Pomona-Westinghouse Unidrive, which is furnished in all sizes up to and including 100 hp. A great convenience of this type is the electric motor built into the pump head and an automatic starting and stopping device which operates by merely pushing a button.

Wells as small as 4 in. inside diameter can be operated by these pumps and any number of gallons—from 25 to 4,500 per minute—are available, according to size of pump. If the water level recedes, it is only necessary to add additional pump column or stages.

Stover Improves Oiling System

On previous Stover engines there were from 12 to 15 oil holes or cups which required an oil supply at least once an hour, in some cases more frequently. The newest model Stover engine carries its supply of oil in a crank case and a splash lubricating system provides for its constant automatic distribution to all working parts. All hand oiling is eliminated.

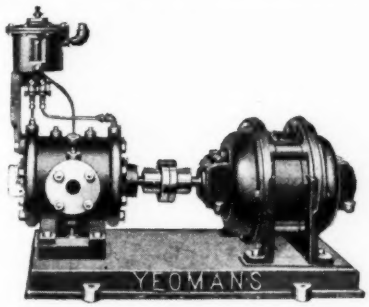
Stover engines are particularly adapted for operating such machines as concrete mixers, pumps, hoists, sawing outfits, etc., where the air is apt to be filled with dust, sand, sawdust or other foreign matter which naturally falls upon and clings to the ordinary open-type horizontal engine. The oil tight crank case enclosure on the new Stover product forestalls all trouble and wear caused from such conditions.

This new engine is interchangeable with all Stover engines of the same size, already in the field.

Literature fully descriptive of this product can be had by addressing the Stover Manufacturing & Engine Company, Freeport, Ill.

Yeomans Rotary Air Compressor

A new type of air compressor has been developed by a 30 year old manufacturer of pumping machinery, Yeomans Brothers Company, 1423 Dayton St., Chicago.



Yeoman's Newest Rotary Air Compressor

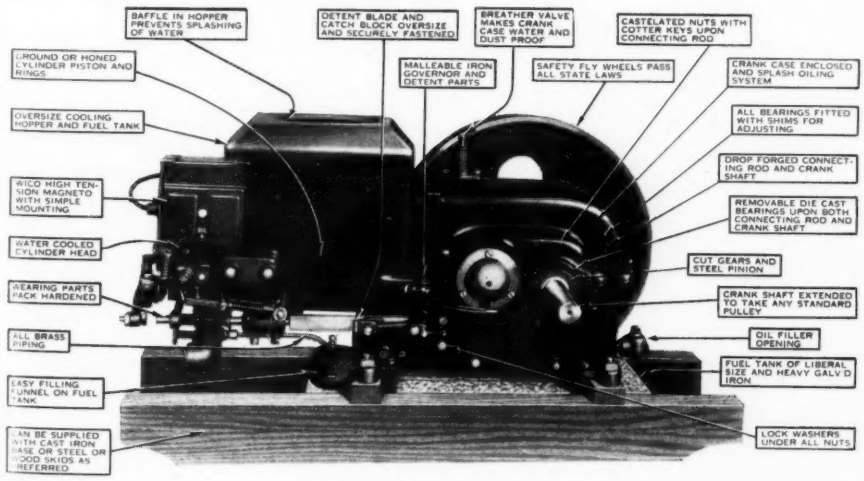
The compressor is of the rotary, multi-vane type and is quiet running, automatically oiled and direct connected to motor or other prime mover. There are no belts, pulleys, gears or valves, small space is required, wear is practically eliminated and because of simplicity of design, is light in weight.

Because of the rotary multi-vane design, the Yeomans compressor produces a continuous, nonpulsating flow of air in contrast to the pulsating flow of reciprocating compressors. This continuous air flow permits, in many cases, operation on air lines without storage tank.

No water seal is employed and the machine is lubricated with oil, so that there is no corrosion of working parts. The shaft is sealed by means of metallic packing rings with automatic spring adjustment, so that stuffing boxes are eliminated.

Automatic lubrication is effected by the use of Yeomans oil economizer, a device which lubricates only when compressor operates, and insures thorough and positive oiling at all times and eliminates the possibility of corrosion and prevents waste of oil.

The compressor is suitable for any air service in municipal or industrial work where pressure up to 50 lb. is required.


BAFFLE IN HOPPER PREVENTS SPLASHING OF WATER
DETENT BLADE AND CATCH BLOCK OVERSIZE AND SECURELY FASTENED
BREATHER VALVE MAKES CRANK CASE WATER AND DUST PROOF
CASTELATED NUTS WITH COTTER KEYS UPON CONNECTING ROD
GROUND OR HONED CYLINDER PISTON AND RINGS
MALLEABLE IRON GOVERNOR AND DETENT PARTS
SAFETY FLY WHEELS PASS ALL STATE LAWS
CRANK CASE ENCLOSED AND SPLASH OILING SYSTEM
OVERSIZE COOLING HOPPER AND FUEL TANK
ALL BEARINGS FITTED WITH SHIMS FOR ADJUSTING
DROP FORGED CONNECTING ROD AND CRANK SHAFT
WICO HIGH TENSION MAGNETO WITH SIMPLE MOUNTING
REMOVABLE DIE CAST BEARINGS UPON BOTH CONNECTING ROD AND CRANK SHAFT
WATER COOLED CYLINDER HEAD
CUT GEARS AND STEEL PINION
WEARING PARTS HACK HARDENED
CRANK SHAFT EXTENDED TO TAKE ANY STANDARD PULLEY
ALL BRASS PIPING
OIL FILLER OPENING
EASY FILLING FUNNEL ON FUEL TANK
FUEL TANK OF LIBERAL SIZE AND HEAVY GALV'D IRON
CAN BE SUPPLIED WITH CAST IRON BASE OR STEEL OR WOOD SKIDS AS PREFERRED
LOCK WASHERS UNDER ALL NUTS

New Stover Industrial Engine

Coldwell Power Lawn Mowers

The Coldwell Lawn Mower Co., Newburgh, N. Y., give the following general specifications of their mowers for use on municipal and waterworks maintenance jobs:

General Specifications

Two-cylinder 4-cycle gasoline engine for Twin-30 and L Twin models. One-cylinder 4-cycle for L Jr. and Cub models. Water cooled with radiator and fan. Completely enclosed and automatically lubricated with oil pump. Crank shaft mounted on Timken tapered roller bearings. Tillotson automobile type carburetor. Bosch high tension magneto. Governor control. Abundant reserve power for grades. Channel steel frame on mower chassis. Full width two-section drive roller with differential. Separate clutch for drive roller and for cutting knives with individual control levers on handle. Automobile type clutches; no adjustment required. Transmission and clutches enclosed. Five blade cutter. Roller bearings throughout. Alemite-Zerk force feed lubrication. Simple and economical in operation and thoroughly dependable. Grass box, also riding sulky may be had as extra equipment.

Coldwell Power Lawn Mower

Coleman Sewer Rod Point

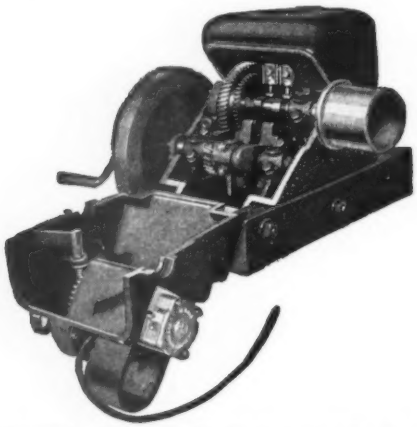
Allen J. Coleman of Chicago has developed a sewer rod point that will roll its way through stoppages and around bends. It is constructed of two roller wheels, rolling at right angles to each other. This new article, the manufacturer states, has been tested out and found to be an efficient tool.

The manufacturer also announces an improved lead point runner. The clamp is furnished with pouring funnel. It has a long fibre solid core and two braided jackets of high heat resistant, strong yarn. The foot plate is formed so as to hold clamp in place on pipe until asbestos rope is drawn tight and locked by lever clamps.

New Portable Engine Has Many Interesting Features

A new line of gasoline-kerosene engines in ratings from 1½ to 7½ hp. recently announced by Fairbanks, Morse & Company of Chicago, incorporate a number of interesting features. While the most radical departure from previous construction is in the all-enclosed self-oiling feature, the new engine is quite different in appearance from other small engines of its type.

The 1½ hp. rating, which is a size



Removal of Two Bolts Permits Opening Enclosure of the Fairbanks-Morse Engine and Exposes All of the Working Parts. Two Speed Arrangement of Pulleys Is Also Shown

used in a wide diversity of drives, such as portable pumps, air compressors, generator saws, grinders, polishers and similar uses, is the most interesting development in the new line. It is less than 16 in. high, 22 in. long and 19 in. wide and weighs 150 lb.

Two pulleys are provided, one of which operates at the engine speed of 1,500 r.p.m. and the other at 750 r.p.m. There is also a mechanical regulator which permits slowing the engine down to 1,100 r.p.m. with, of course, proportionate reduction in horsepower. With the two pulley speeds and the speed regulator it is possible to meet the requirements of almost any type of drive.

An important feature about the new 1½ hp. unit is its simplicity in design. There are said to be 25 per cent less parts than in previous engines of this size. Unit construction throughout makes the cylinder, water hopper, crankcase and bearing supports for both crankshaft and camshaft integral parts of the cylinder and base casting. The engine, with the exception of the magneto, can be entirely assembled on this casting.

Complete protection from dirt, dust, rain and snow is afforded through the fully enclosed feature. By the removal of only two bolts, all working parts, such as the crankshaft, camshaft, bearing, etc., are open to view and inspection.

Removal of eighteen bolts completely dismantles the entire engine.

Self-oiling is accomplished through a special lubricating system which literally drenches all working parts in oil. No grease cups are required.

The base casting serves as an oil reservoir. The bearing caps have caps to collect the oil which drips from special baffles located directly above on the crank case cover.

One of the special mechanical refinements is the method by which leaking of oil is prevented. Felt retainers on the crankshaft and camshaft—return oil grooves on these shafts—and a special crankcase breather eliminates all possibility of leaking oil. The crankcase breather, further, does away with compression in the crankcase. Instead of forcing the oil out at the gaskets, the special breather sucks in all oil collected at the gaskets by maintaining a vacuum within the crankcase.

Improved Speeder Shovel-Crane Announced

The Speeder Machinery Corporation, Cedar Rapids, Iowa, manufacturers of ½-yd. full revolving, convertible gasoline shovels, introduced and showed for the first time at the road show, the improved Speeder, model B-3, much faster and more powerful than previous models.

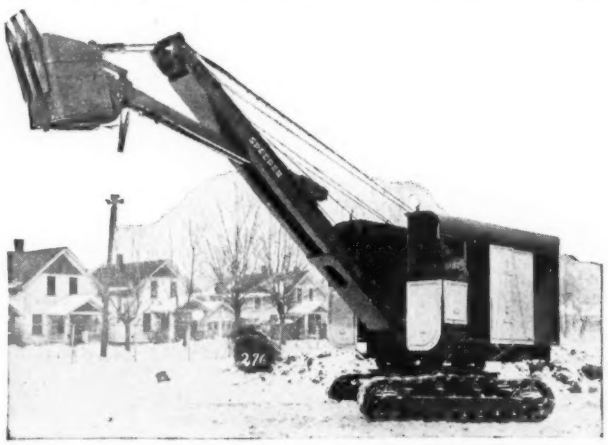
The improved Speeder, model B-3, has a hoist line speed of 180 ft. per min., a swing speed of more than four revolutions per minute and a travel speed of 1½ actual miles per hr. in high gear, and .55 mile per hr. in low gear. In low gear the machines will climb a 35 per cent grade.

The patented Speeder direct cable crowd is used. The working principle is the same as in previous models, but it is improved in view of the fact that two short cables rather than one long cable is used, thus necessitating the replacement of a short cable rather than a long one in case of breakage. The speed of the crowding action also has been increased.

Among other improvements found on the improved Speeder model B-3 is a greatly improved ultra-positive steering mechanism that permits sharp or gradual turns under most adverse conditions; heavier construction throughout; electric lights and starter as standard equipment; a new style steel cab; six carrier trunnions for the upper body rather than four, as in previous models, and a motor with 4¼x5¾-in. bore that develops full 53 hp.

The improved Speeder, model B-3, as a shovel has for standard equipment a boom 18 ft. in length and as a crane carries either a 30 or 35-ft. boom and the working load is 10,000 lb.

Further information may be obtained from the Speeder Machinery Corporation, Cedar Rapids, Iowa.



Model B-3 Recently Announced by Speeder Machinery Corporation

New La Motte Equipment

La Motte Chemical Products Co., McCormick Bldg., Baltimore, Md., are now putting out all standards for water analysis in closed Nessler tubes with

La Motte Colorimeter for Nessler Tube Comparisons

polished tops and bottoms. The tube is filled through a side arm which is then sealed off, preserving the standard from contamination of any kind. Standards for color, nitrogen, chlorine, total iron, nitrite, nitrate, ferrous iron and manganese are available.

This special colorimeter is 7 in. long, 4 in. wide and 9 in. high. A piece of etched glass is placed directly below the bottoms of the tubes, and below this is a mirror set at an angle of 45

deg. An open Nessler tube containing the test sample is placed in the central hole and two consecutive standards in the holes on either side. Holding the upper ends of the tubes toward a source of daylight, the comparison is made by looking into the mirror. The colorimeter should be used in all comparisons with the sealed Nessler standards.

A complete new series of indicators has been developed to cover the pH range 9.6 — 13.6. These new indicators are especially useful for pH control in water softening.

Large Collapsible Swimming Pool

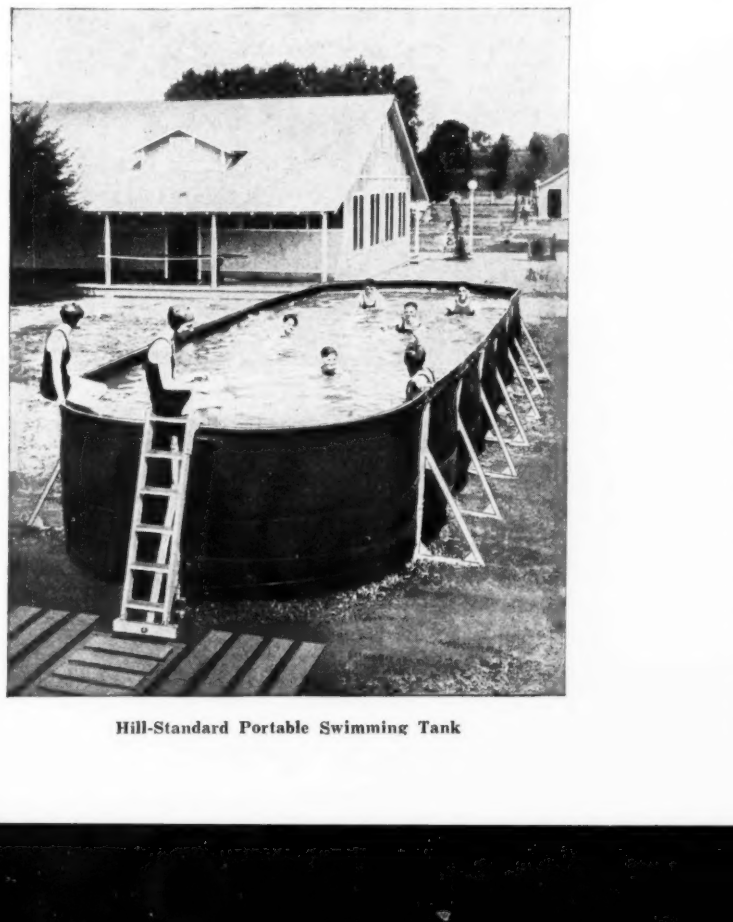
A portable collapsible swimming pool made of a new and almost indestructible Wunder cloth is one of the latest products of Hill-Standard Co. of Anderson, Ind.

The pool when set up is 40 ft. long, 10 ft. wide and 57 in. deep, holding 12,100 gal. of water. It is easily trucked to any point, and quickly set up and taken down. Angle iron supports keep it rigid. The Wunder cloth wall laps smoothly over the iron top rim and down, being laced to the top rim. Bathers are thus fully protected from all metal.

This new pool has a variety of uses. It is already in use in Eastern tourist camps. It is equally desirable for summer camps, groups of summer homes, near the water as well as inland. Its advantages will be appreciated for carnivals, amusement resorts and beaches, where beginners learn before going into the lake or ocean.

It makes fine provision of bathing facilities in parks, recreation grounds and clubs lacking permanent installations. It is also adaptable as a temporary sectional municipal pool. The low cost brings it within reach of many institutions which have had to do without pools.

It is claimed for this new pool that it is practically non-crackable, being protected by a finish in a new special process which holds the flexibility in exposure to all weathers. The pool is fully described in the new Hill-Standard water sports catalog, a copy of which will be sent free on request.



Hill-Standard Portable Swimming Tank

New Universal-35 Developed

The Universal-35 is a ½-yd. capacity machine, built by the Universal Crane Co., Lorain, O.

It is mounted on a two-speed center drive crawler. Speed changes and crawler steering are controlled from the operator's position, regardless of the position of swing of the turntable.

Universal-35 Two-Speed Crawler

The superstructure proper is of the same design and construction as has been built for the past several years as the Universal Truck Crane. The superstructure can be mounted on either the two-speed crawler or a 5-ton motor truck chassis and is readily transferable from one to the other.

The boom equipment offered on the Universal-35 consists of crane booms 16 to 56 ft. long, ½-yd. center drive shovel, backdigger booms, clamshell and dragline bucket equipment and skimmer. All boom equipment is readily interchangeable.

New Orton ⅝-Yd. Convertible Shovel

One of the developments in shovel design by the Orton Crane & Shovel Co., Chicago, is their model A convertible ⅝-yard shovel. Its light weight, small over-all clearances and high mobility make it particularly suitable for excavating and grading contractors, material yards, industrial plants and similar applications.

Chief among the features of the Orton model A machine are the well balanced design, the scientific distribution of material, the use of alloy steel for all power shafts and gears, and the extension of cab so that the work can be seen from both sides of the operator's position. These features contribute greatly to speedy operation, and the sturdy construction insures a machine of endurance. Strength and rigidity of the base are obtained by building it of rolled plates and shapes which are thoroughly riveted and electric welded. The use of structural steel combines lightness with uniformity of material. Electric welding gives the necessary rigidity for supporting shafts and bearings, and for withstanding operating strains.

Orton Model A 6-ton Crane Equipped with Orton ½-Yard Excavating Clamshell Bucket

Flexible crawling treads of the spring type absorb shocks and protect the operating mechanism from undue strains. The springs distribute the weight of the machine uniformly over the treads so that it is not concentrated when the machine travels over uneven ground, logs or other obstructions. The treads

are self-cleaning and will not clog with loose dirt or stones. The model A can also be furnished with road wheels or for mounting on standard auto-truck chassis.

All of the power shafts are made of alloy steel, and are turned and ground. Each power shaft is in a horizontal position, and can be removed without interfering with any of the others. Interchangeable phosphor-bronze bushings are provided for all bearings. Gears are made of special heat-treated alloy steel, and all spur gears are cut from solid blanks.

An abundance of power is provided by the heavy-duty 53-horsepower Hercules motor, which is provided with an electric starter as standard equipment.

The model A can be furnished with shovel, crane, dragline, ditcher or skimmer attachment, and can be changed from one to any other in the field in less than two hours, it is claimed.

A feature of the shovel, the manufacturer states, is the positive crowding action, the full power of the engine being transmitted directly to the digging edge of the dipper by the patented gear-driven crowding device. The shipper shaft is driven by a slip friction adjusted to release before the main clutches slip or the engine stalls. In operation, the crowding clutch is thrown in completely, and a constant thrust is maintained on the dipper, the slip friction acting to absorb shocks and jars, and to prevent killing the engine or transmitting undue strains to the power clutch. The entire crowding mechanism is integral with the boom, thus facilitating changes to other attachments.

The model A crane has a lifting capacity of 6 tons at a 12-foot radius, and, when equipped with a standard 30-foot boom, handles a ½-yard bucket throughout its operating range. Booms 35 or 40 feet long can be furnished for hook operation.

The patented Orton T head on the ditcher attachment gives maximum pull back when the dipper stick is nearly horizontal, and minimum pull when the scoop is in a digging position. This arrangement affords great digging power and also serves to snap the scoop back quickly when dumping. Two drums mounted on the boom, one on the top leading to the hoist drum and the other leading to the scoop, eliminating a sheave at the scoop, and give straight, direct pull.

The dragline has a 30-foot, lattice-type boom, and the fair-leader slides so as to give the most direct lead possible to the drum, being carried on a bronze-bushed, cast-steel lead sheave, with guard sheaves properly balanced so as to produce a minimum amount of wear on the cable. It handles a bucket with a capacity of ½ cubic yard.

The model A skimmer is provided with a steel boom, from which the scoop is suspended by means of bronze-bushed steel rollers. It has an effective length of travel of 11 feet, and the scoop has a capacity of ½ cubic yard, with a width of 30 inches, although special widths can be furnished.

New Dorr Equipment in Sewage and Water Works Fields

The Dorr Company of New York has introduced within the last year or so three new equipment units for the more effective mechanical solution of such frequently met sanitary engineering problems as coarse screening, grit removal and washing, and agitation or mixing. Each new unit is allied in a sense with existing Dorr sanitary equipment in that it precedes and supplements the Dorrco screen, Dorr traction clarifier and Dorr sewage digester.

The Dorrco bar screen consists essentially of two main parts:

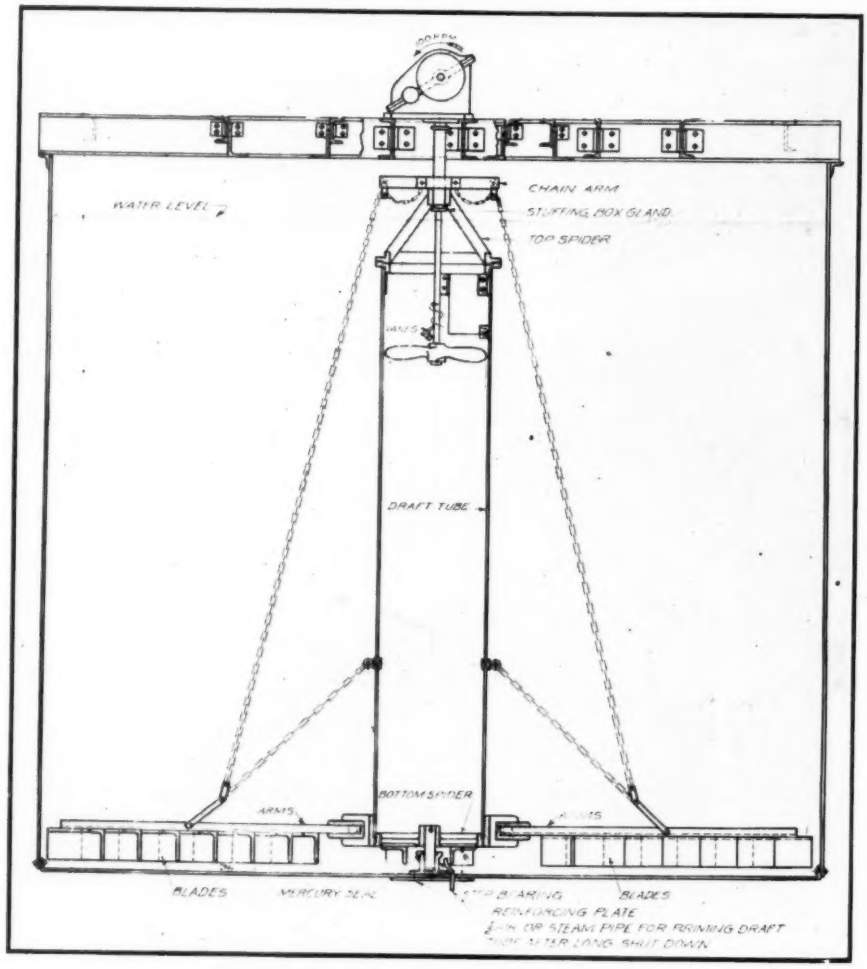
1. The stationary bars forming the screen.

2. The cleaning mechanism for removing the screenings which are deposited on the bars.

The straight bars forming the screen are similar to those used in plain bar screens, and usually are ¼-in. by 3-in. bars, placed in the channel at an angle of 60 deg., the opening between the bars depending on local conditions.

The cleaning mechanism consists of raking mechanism with supporting frame, drive mechanism with supporting frame, and rake scraper for removing the screenings from the raking mechanism.

The Dorr Detritor is an automatic, self-cleaning grit chamber, for general use in place of the conventional grit settling troughs at sewage disposal plants. The name Dorr Detritor has been taken from the word "detritus," which is usually used to refer to the inorganics in sewage. This machine performs all of the functions of the grit settling channels and in addition automatically collects and washes the grit, delivering it finally in a clean, dewatered condition to a suitable receptacle.



Sectional View of New Dorr Impeller Agitator

The Dorr Impeller Agitator is the most recent equipment development of the Dorr Company in the water works field. This unit is designed to give that type of efficient mixing which is so important in the chemical softening of hard waters and the chemical dosing

of turbid waters. A feature of considerable importance is its ability to turn over a large volume of water at a velocity which does not break up flocs.

Reco Traffic Control

The accompanying illustration shows one type of Reco variable control which has been the "Mechanical Traffic Officer" of a great many of the Stop and Go signals throughout the U. S. A. since automatic traffic regulation was adopted.

The adjustment of this control as well as that of other types of variable controls made by the manufacturers,

Reynolds Mechanical Traffic Officer

The Reynolds Electric Company of Chicago, is of the thumb screw type, permitting the regulation of the speed of the drum during one-half of a revolution. This enables the officer in charge of traffic to regulate east and west or north and south traffic to suit the peculiar conditions of the intersection.

Assuming that the traffic control is set for 30 seconds north and south or one cycle in 60 seconds, the thumb screw enables changing to either 40 to 20 seconds of any point in between or vice versa. In other words, a 33⅓ per cent variation faster or slower in either direction can be secured by this feature of the Reynolds variable traffic control.

The Reynolds Electric Company also manufacture flashers for blinkers, flashing beacons, stop or warning lights, airport lighting needs, alarm signals, etc. Information bulletins are furnished cheerfully upon request.

Fusee Screw Water Level Recorder Improved

Julien P. Friez & Sons, Inc., of Baltimore, announce the development of the Air Fusee screw water level recorder. The instrument records water level variations on a continuous roll and will operate continuously for 60 days without attention.

Outstanding features claimed for the instrument follow:

Simplicity, the design embodying a minimum of moving parts without delicate mechanisms.

Ease of operation, with dependability and accuracy of performance under adverse conditions.

Fusee paper drive, which avoids the complicated system of rollers common to other designs and provides means of adjusting the paper drive to eliminate time errors.

Record placed directly on original roll, before the paper has had a chance to shift laterally or otherwise alter its original condition.

Endless screw pencil drive, so constructed that the pencil carriage will reverse at either end without changing the rate of lineal motion at the point of reversal.

Positive drive float wheel, which eliminates all gage height errors due to slipping or improper seating of the float cable.

Jewelled clock, weight driven, with dial and hands for indicating time, connected to driving mechanism by universal joint and removable without tools.

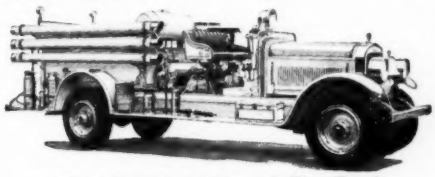
Easy removal of sections of chart, when records covering short intervals of a day or week are desired.

The distinctive feature of the recorder, and that from which it received its name, is the slightly conical, spirally grooved pulley, known in clock making as a "fusee," the function of which is to drive the paper at a constant lineal speed.

Pirsch Improved Fire Truck

Peter Pirsch & Sons Co. of Kenosha, Wis., announces an improved 1,000-gal. fire pumper.

The motor, transmission, axles, rotary pump, chassis and fire equipment design and construction is improved, evolved after years of study of fire department problems. Great strides have been made in motor design since the



Pirsch-Standard Improved Fire Truck

first pumpers were built. The motor in this 1,000-gal. pumper delivers its full rated capacity of 1,000 gal. at 120 lb. per pump pressure from suction. The Pirsch-Standard 1,000-gal. pumper delivers its rated capacity from suction at 120 lb. net pump pressure at 1,350 rpm. of the motor or only 67 per cent of the maximum, which means a reserve of 33 per cent. When operated at close to its safe maximum operating speed it has pumped 1,312 gal. of water at 127 lb. net pump pressure from suction.

The truck comes fully equipped. It has a rotary type pump with stainless steel shafts, synchronizing gears, positive dependable relief valves, also auxiliary force feed oil pump, built in, which lubricates all moving parts requiring lubrication.

Pressed Brick Important Item

The new Howard's Bend plant of the St. Louis, Mo., water works system at present includes a group of buildings consisting of high and low pressure engine houses, boiler house, coal receiving house, filter house, head house, coagulant house, and two gate houses at the settling basins.

The interior of these buildings necessarily must be of the most scrupulous sanitary nature. The architects, Messrs. Study & Farrar, solved the problem so far as the wall surface was concerned by the use of enamel brick. In order to avoid the glare of white enamels, the Hydraulic-Press Brick Company of St. Louis developed especially for the architects and under their direction, a soft special shade of gray which provides to be both pleasing to the eye and attractive in appearance, practically eliminating glare. These great wall expanses, however, are not left without a relieving trim and, for this purpose, the company furnished the architects with a transparent speckled buff enamel brick which is used around all windows and doors, and not only for a base but also for all horizontal and vertical trim lines. It may be interesting also to know that the pits in both the high and low pressure houses, where the big pumps are installed, are lined from top to bottom with gray enamels.

New Type Hydrant Devised

Shand and Jurs Co. of Berkeley, California, have developed a new hydrant especially applicable to climates where freezing does not occur. All of the operating parts are in the head. Instead of shutting the water off at the base of the plug it is allowed to be in the head continually and to enter the hose connection by opening a valve which closes that connection. The valves operate directly on the hydrant hose connection passage ways.

The hydrants are made with various sized openings.

Lorain 55, a New 1-Yd. Machine

Recent developments in the excavating and material handling fields have created a distinct need and demand for a 1-yd. machine of the calibre, construction, speed and design of the 1¼-yd. Lorain-75, according to the Thew Shovel Co., of Lorain, Ohio.

All the advantages of Thew Center Drive principle, as proven by the Lorain-75, direct power, rugged strength, high speeds, smooth, positive three lever control, and high standards of construction and materials are duplicated in the new 1-yd. Lorain-55. All three power shafts can be engaged at once, giving three simultaneous operations, independently controlled.

The 1-yd. Lorain-55, while it incorporates the successful design features

Lorain 55, Thew's New 1-Yd. Machines

of the Lorain-75, is not a machine "cut down" or "built up" from other capacity units. Rather, it is an entirely new superstructure designed and built throughout of a size, strength and weight to most efficiently handle a 1 cu. yd. struck measure.

On bin charging, material rehandling, stock-piling, and on large sewer clamshell excavations and backfilling, the Lorain-55 offers an improved 1-yd. crane.

Due to an easily adjustable slip friction on the holding drum, the Lorain-55, as a clamshell, is operated by only two hand levers and two foot pedals. Booster bands on the hoist clutch controls insure easy, responsive operations.

Harnischfeger Builds Side Wheel Trencher

A new side wheel trenching machine, recently added to the line of excavating equipment manufactured by Harnischfeger Corporation, Milwaukee, promises to be an exceptionally popular model with public utility companies.

The Pacific Gas & Electric Company, San Francisco, Cal., has just purchased one of the new wheel type machines for use on a 76 mile pipe line job near San Francisco. It is averaging approximately 1,300 ft. of trench per eight hour shift—cutting to a depth of 4½ ft. and 28 in. wide, the manufacturer states.

A side wheel trench of this type has several distinct advantages for city work. The cutting wheel, being mounted at the extreme left hand side of the machine, permits cutting exceptionally close to a line of telegraph poles or close to the street curb. The side wheel feature is also a valuable aid when cutting trench close to the edge of a highway. The cutting wheel projects 2 ft. beyond the outer edge of the crawler, making it possible for the entire traction to remain on the hard road or pavement—thereby avoiding the expense of planking up a low side.

The machine is equipped with a 55 hp., heavy duty Waukesha engine which consumes approximately 35 gal. of gasoline per eight hour shift. The wheel has a cutting range of 20 to 28 in. in width and can dig trench to a depth of 5 ft.

Kupferle Tests Hydrants

Recent tests on the new Kupferle fire hydrant shows it is to pass all requirements of the Associated Factory Mutual Fire Insurance Companies.

This hydrant is manufactured by the John C. Kupferle Foundry Co. of St. Louis, Mo.

The barrel is made in three sections. The top section embodies a stuffing box for the operating stem and serves as a cap for the hydrant. The middle section is a cylindrical casting provided with a flange on each end and with two outlets spaced 90 deg. apart near the upper end. The outlets are provided with 2½-in. bronze hose nipples, which are threaded and pinned in place.

The seat ring casting is of bronze and is threaded into the upper part of the inlet barrel section.

Two pair of vertically extending bronze guides located diametrically opposite each other are cast on the upper part of the seat ring casting to guide the valve mechanism.

A 5/16-in. drain hole is provided in the seat ring opposite the annular groove in the upper part of the lower barrel section, this hole being closed by the drip valve when the hydrant valve is in the open position. The lower end or face of the seat ring is beveled at an angle of 45 deg.

The diameter of the waterway through the seat ring is 5½ in.

Capillary Comparator

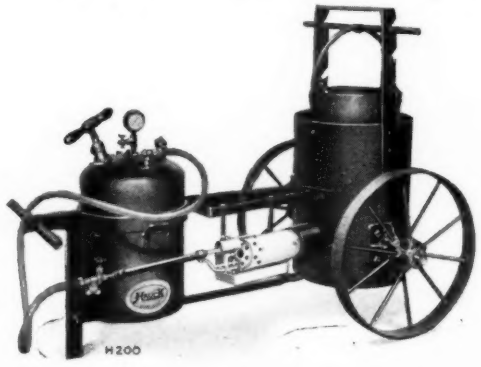
Eimer & Amend of New York announce the development of a comparator for hydrogen ion determinations. The Hellig comparator uses permanent, non-fading glass standards, but the glasses are rectangular plates and are enclosed entirely in a glass housing, acid and dust-proof, thus forming a convenient color scale. The capillary tube, which contains the solution to be tested, together with the indicator, is held by a metal rider which moves along the color scale. This rider has a milk glass back for diffusing the light, an opening in front for securing the proper color field, and two openings at the margin for reading either the horizontal or the vertical pH valves, depending on how the rider is placed on the scale. Each color scale is marked horizontally and vertically with the corresponding pH value for readings in either position of the apparatus. The color comparison may be made and the pH value scale can be read from one point of observation. As the color fields are close together a very good match is obtained. The metal rider can be used with any of the glass color scales.

This outfit is very handy for measuring hydrogen ion concentration for minute quantities of test solution, only one drop being required.

New Hauck Lead Melting Furnace

The new line of Hauck combination melting furnace and portable torch equipments, on legs and on wheels, are designed for heat control, a new and exclusive Hauck feature. Instant and positive heat control under the pot is secured by the new slide-rail burner construction. For full heat, simply push burner forward on slide-rail; for less heat, pull burner away from furnace. Each size of burner gives an intense,

P. & H. Side Wheel Trencher Recently Developed



Hauck Slide Rail Lead Melting Furnace

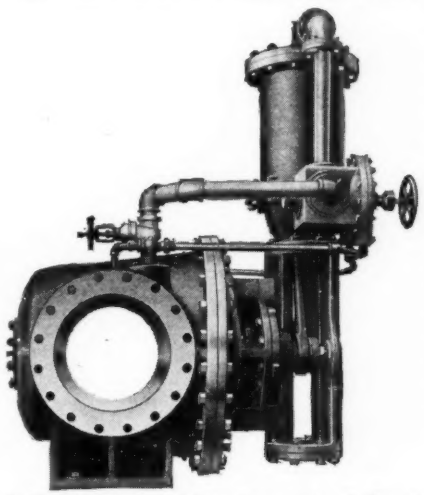
reddish blue, clean and steady flame from 1,600 deg. to 1,800 deg. F. with no smoke.

Write Hauck Mfg. Co., 141 Tenth St., Brooklyn, N. Y., for bulletin No. 101 illustrating and describing the above lead melting combinations.

Outboard Type Valve Announced

The advent of the centrifugal pump in pumping stations introduced some interesting problems to the waterworks field. Particularly were engineers in this field concerned with check valves. Several different styles of check valves were tried to meet varying conditions.

The Automatic Cone Valve Company of Chicago, have developed valves which have the inherent features that



Automatic Cone Valve Company's Outboard Type of Valve Recently Developed

are of utmost importance to the operating engineers. The fact that when the cone valve is in full open position, the waterway is similar to a piece of pipe and reduces frictional resistance to a minimum. This question of friction plays a very important part in the design and layout of plants and pipe lines; wherever obstructions are eliminated the increase in pressure can be evaluated on a dollars and cents basis which reflects itself into increased efficiency.

The Automatic Cone Valve Company first produced what they now term the Inboard type of valve which first made its appearance at the American Waterworks Convention in Chicago, Illinois, during June of 1927. At that time, the engineers were very much impressed by its quick and easy operation. Later developments naturally tended to simplify construction and improve the operation. The accompanying picture very clearly shows the circular waterway without obstructions. All the operating mechanism is "outboard" and can be inspected without interfering with operation. In fact, every part of the hydraulic mechanism can be removed and replaced without shutting down the pipe line.

The cone valve has the inherent advantage of having a plug which is mounted in bearings and revolves freely on these bearings during operation without the seats coming in contact with any other metal. It is a surface of revolution fitting into another surface of revolution, and therefore, can be lapped into its own seat, making the tightest valves known. For operation in gritty water, the rotation of the plug has a selfcleaning effect. The accompanying picture shows the automatic cone valve which is composed of two distinct mechanisms. The hydraulically operated cone valve and the control mechanism which properly times the opening and closing of the valve eliminate shock and water hammer. Cone valves are made for electrical, manual or hydraulic operation. All automatic cone valves are hydraulically operated. Manually operated and electrically operated cone valves are very adaptable for use as stop valves controlling distribution systems where pipe diameters are of large size.

The automatic cone valve is so designed that it does the double duty of both a stop and check valve. This operation is accomplished by installation of the control valve having two Pitometer connections through the valve proper which register the condition of flow against the diaphragm unit control valve. The movement of this diaphragm distributes the power water to the proper side of the hydraulic cylinder which in turn opens or closes the cone valve itself.

New Laboratory Media

In the not so distant past much importance was ascribed to the spore-forming anaerobes as indicatory of sewage pollution. Today, however, the chief interest of the water bacteriologist in the spore formers is due to their interference with the presumptive test for Esh. coli. Spores may persist for indefinite periods in polluted waters. Their presence, therefore, does not indicate recent or dangerous pollution, nor does it distinguish between the decomposition of animal and plant wastes.

Bacto-Brilliant Green Bile and Bacto-Brilliant Green Bile, 2% Special have been developed by the Digestive Ferments Company, Detroit, Michigan, cooperating with Committee No. 1 Standard Methods of the American Water Works Association, as two dehydrated culture media for the purpose of eliminating the confusion resulting from non-confirmable presumptive tests. Both the dye and bile act as inhibitory agents, preventing the development of the spores, but permitting the growth of the gram-negative, non-spore forming, lactose fermenting organisms.

Bacto-Brilliant Green Bile is prepared according to the formula of Muer and Harris. The dehydrated medium has been used with satisfaction by many sanitarians. Bacto-Brilliant Green Bile, 2% Special, is made up to contain a reduced content of bile with the dye present in a 1:75000 concentration. This medium also is very satisfactory for the presumptive test.

The use of these media in the water bacteriologist's laboratory is still a tentative procedure. Much study has already been, and is still being, undertaken to determine the value of the inhibitory action. Results would seem to indicate that both of these media are of distinct value, especially with certain types of waters.

Further information on how to manipulate the tests will be furnished by the Digestive Ferments Co., of Detroit.

The Northern Valve Announced

The Northern Pump Company of Minneapolis, Minn., describe their newest development, the Northern Valve. Northern double packed valves are of the stop cock type, packed both at the top and the bottom, a design and construction completely covered by U. S. patents. This valve was formerly known (1921 to 1928) as the Victory FcH double packed valve, made by the Victory Manufacturing Company of Niles, California. Ordinary makes of plug valves (stop cocks) have failed to attain wide general use because of the inherent tendency of plug valves either to stick or to leak, according to the manufacturer.

Northern double packed valves have stuffing boxes located at the top and bottom of the plug, the two points where leakage could occur, and can't keep leaking. They cannot stay stuck. Slight tightening of the bottom packing gland usually will loosen a stuck plug, but if this should fail, a sharp blow on the bottom will certainly jar loose a plug which has become stuck tight.

Northern double packed valves are lubricated by a simple but positive method, insuring correct lubrication of valves used in air and gas lines which carry no liquid and are normally dry. Alemite fittings are installed on valves which require lubrication, at the request of the purchaser. Otherwise the openings will be closed by plugs, interchangeable with the Alemite fittings.

The valve ports are regularly rectangular in shape, of practically the same area as the corresponding pipe. These regular ports are called Smoothway. If the valve is required for throttling service, Diamond ports may be had at the option of the purchaser. Three-way and four-way Northern valves are available, in the Smoothway type, also a line of stream jacketed valves. For further information, address Northern Pump Co., Minneapolis, Minn.

Hydraulic Oil-Power Jacks for Hydraulic Field

For general utility in the water works field the Blackhawk Manufacturing Co., Milwaukee, Wis., announce their hydraulic oil-power, gauge-equipped jacks. These jacks are in favor wherever accurate maximum loads or strength of material must be tested easily and economically.

Jacks with gauges are used to determine weights of loaded trucks; strength of concrete or vitrified pipes; testing concrete beams for bending or shear; sinking piles to pre-determined loads; press work and many other uses where total weights of load, or pressure per square inch is desired.

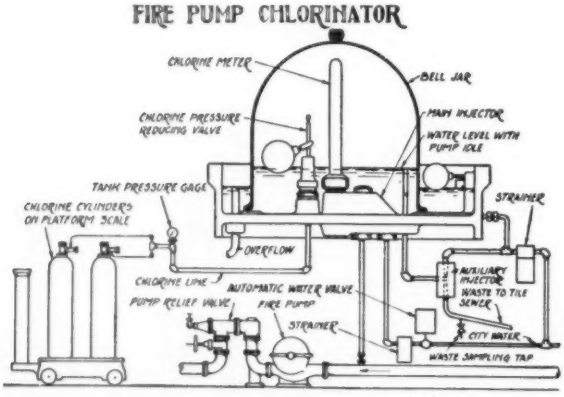
Blackhawk Jacks can be equipped with gauges of any size or tonnage and with graduations to suit the needs for industrial, laboratory and experimental tests.

Gauges are individually hand calibrated to conform to the Bureau of Standard Specifications for Hydraulic Gauges which means that they must be correct within 2 per cent plus or minus of the reading indicated.

Due to lightness and compactness most Blackhawk jacks can be handily operated by one person on any job. They have double utility as when not in use for testing, the gauge is easily removed, a half inch pipe plug inserted and the jack used for any other lifting work.

New Fire Pump Chlorinator

In co-operation with representatives of the fire underwriters and the New York State Department of Health, Wallace & Tiernan have developed a new fire pump chlorinator. The equipment was designed to meet conditions in those industrial plants where it was found absolutely necessary to maintain a cross connection between the fire system from a secondary source and the public water supply. Installations in New York State are in conjunction with factory mutual type double check valve.



Wallace & Tiernan's New Fire Pump Chlorinator

The chlorinator used is the standard Wallace & Tiernan vacuum type solution feed equipment. A small auxiliary injector is provided which is operated continuously from the city water system, discharging to waste a small quantity of chlorine solution (1 to 2 lb. per day). Operation at this low rate keeps the chlorinator in readiness at all times for emergency use when the fire pump is put in operation. Water from the fire system supplies the main injector of the chlorinator and automatically feeds chlorine to the fire pump supply at a predetermined rate to assure sterilization of the water. This rate of feed is constant. The chlorinator is set in accordance with specifications of the state board of health. The chlorinator is not sold for installation except under conditions approved by the state board of health.

In practice the operation of the auxiliary injector is checked daily by testing for chlorine in the water discharged to waste. Weekly tests are required in accordance with the requirement of the state board of health. Careful records are kept of the operation of the fire pump chlorinators.

This equipment promises to be a practical solution of the difficult health problem of assuring protection against local cross connections within industrial plants where of necessity a secondary fire water system must be provided.

For further information write to Wallace and Tiernan of Newark, N. J.

Automatic Pressure Controller

The Electric Controller & Mfg. Co. of Cleveland, Ohio, has developed altitude and pressure regulators for automatic control of pressures and liquid levels which are applicable to the water works and general municipal field.

E C & M automatic pressure control equipments are used with motor driven apparatus for the automatic regulation of water, liquids, air or gases.

These equipments are made in two types designated as altitude regulators and pressure regulators. They differ only in the design of the regulating gauge.

Altitude regulators include a gauge which registers pressure or altitude with a high degree of accuracy. These gauges are practically frictionless and the pointer will respond accurately to extremely small variations in pressure. Altitude regulators are, therefore, suitable for controlling pressure systems where liquid levels of air pressures must be maintained between extremely close limits.

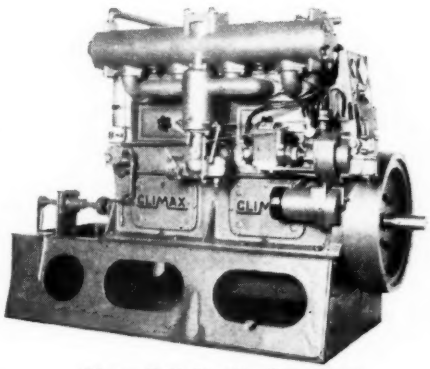
An E C & M altitude regulator panel automatically controls two pumps that discharge into the same tank. This is a very interesting application of the E C & M altitude regulator in that it has many features such as should one pump not deliver sufficient water, the other pump will automatically be started and should one pump become disabled so that it will not maintain the water within the required limits, the other pump will automatically start and the disabled pump will be cut out.

It may also be used in another interesting way in that the pressure of a gas system may be maintained between predetermined limits. The company recently figured on using this regulator in connection with a gas booster pump that was driven by a direct current adjustable speed motor. Should the pressure fall below a certain value, the altitude regulator automatically increased the speed of the motor sufficiently so as to increase the pressure.

Standby Fire Pump

The Climax Engineering Company of Clinton, Iowa, have developed an engine for fire standby service which they call their Model R4U Uunderwriters' Engine.

This engine has been approved by the Underwriters' Laboratories for fire pumps operating at 100 lb. pressure and delivering 500 to 700 gpm., the manufacturer states.



Climax R4U Standby Fire Pump

Climax Model R6U engine is approved for 1,000 gpm. pumps.

Climax Underwriters engines are furnished complete with electric starter, generator and battery, instrument board, including all necessary instruments mounted on engine, water-cooled manifold, stub shaft, vacuum fuel pump and vacuum tank and with or without mounting frame or bed plate, making a complete unit ready to assemble with the pump without additional special mounting and installation engineering.

Blue prints and instructions are furnished with each engine.

Municipal News and Water Works

Published Monthly by

GILLETTE PUBLISHING COMPANY, CONKEY AVE. AND MADISON ST., HAMMOND, IND., AND 221 EAST 20TH ST., CHICAGO

Publishers of

Engineering and Contracting
Municipal News and Water Works
Roads and Streets
Tiles and Tile Work

Road and Street Catalog and Data Book
Water Works Catalog and Data Book
General Contractors' Catalog and Data Book

HALBERT P. GILLETTE.....President and Editor
E. S. GILLETTE.....Vice-Pres. and Secretary
E. B. HOWE.....Vice-President
E. C. KELLY.....Vice-President
T. F. KILROE.....Vice-President
J. M. ANGELL, JR.....Eastern Manager
C. T. MURRAY.....Managing Editor
Cleveland Office.....953 Leader Bldg.
New York Office.....420 Lexington Ave.
San Francisco Office.....703 Market St.

Subscription Price $2.00 Foreign Postage 65c Extra

Copyright, 1929, by Gillette Publishing Company

Discovering Natural Laws a Specialty

Thousands specialize as teachers of scientific laws where scores specialize in discovering new laws. About the same ratio exists between researchers who merely collect facts and searchers who determine their relationships and significance.

As an illustration of the difference between researchers, consider Nicholson, who discovered the ninth satellite of Jupiter, and Einstein, who found out why Mercury's perihelion revolves about the sun. The one photographed the heavens about Jupiter and found a streak on a plate that showed the existence of a new moon. The other busied himself with no telescopic observations, yet by study of the fundamental physics of motion discovered certain laws that may eventually aid in revolutionizing astronomy. Already Einstein has given to astronomers a formula by which the diameters of stars may be calculated if certain spectroscopic data and mass are securable.

Important as is the work of such men as Nicholson, the observer, far more important is the work of such men as Einstein, the interpreter. While observers are relatively numerous, interpreters always have been, and still are, scarce. Curiously enough, most observers seem to be somewhat jealous of interpreters who undertake to explain what the observed facts mean. At any rate they are prone to ignore or to belittle any new theory that relates to their realm. They act as if they regard the theorist as an amateur who is trying to instruct the professional. This attitude indicates failure to realize that the art of discovering natural laws and the formulating of new theories is itself a specialty. Once that art has been well mastered, its possessor usually is able to make discoveries in many different realms. The professional observer or experimenter in each of these realms often fails to understand how an "outsider" can enter his particular realm, quickly penetrate a mass of data and find a hidden law that binds seemingly disconnected facts into an organized whole. The lack of understanding that such an achievement is possible to men who specialize in theoretical research, perhaps accounts for part of the difficulty that the latter find in securing acceptance of their discoveries by the very men who should be the first to put their stamp of approval upon them.

Illustrative of the attitude of many scientific teachers and observers toward research theorists we may cite Agassiz. When he advanced the theory that a great and prolonged ice age had once existed, and that practically all of northern Europe had been covered with a deep ice cap, a chorus of disapproval arose from teachers of geology, many of whom were good observers. Among them was Prof. Braun, who, having taught Agassiz the little that he knew about geology, was particularly certain that he could learn nothing from this former student. "Stick to your fishes, Louis; stick to your fishes," he cried, for what could be plainer than that only a specialized geological observer could ever hope to discover a new geological principle or law? But Agassiz refused thus to be limited, and steadily continued to pile up evidence in favor of his ice age theory. By instinct he was a theorizer, although his training had made him also a good observer. His greatest delight was in discovering some broad principle, and he found a splendid opportunity for such discovery in the realm of geology. Yet it was not for two generations that practically every geologist in Europe had capitulated to the Agassiz ice-age theory.

For the specialist in the discovery of the causes of effects, science often has no boundary. Having learned how to interrogate Nature successfully in one corner, such a specialist usually finds no difficulty in making her answer his "fourth degree" questioning in the other corners.

More than half a century ago it was recognized by a few discerning scientists that the discovery of natural laws is itself a specialty, as the following quotation shows.

E. L. Youmans, in Popular Science Monthly, November, 1874, on "Spencer and Evolution," said:

"In the scientific world, the accumulation of facts has outstripped the work of valid generalization. For, while men of moderate ability can observe, experiment, and multiply details in special departments, it requires men of breadth to arrange them into groups, to educe principles and arrive at comprehensive laws. The great mass of scientific specialists, confined to their departments, and little trained to the work of generalization are apt to regard lightly the logical process of science, and to decry mere theorizing and speculation. They forget that facts of themselves are not science, and only became so by being placed in true relations, and that the function of the thinker is therefore supreme; while the work of organizing facts and establishing general truths is, after all, just as much a specialty as that of observation or experiment in many branches of inquiry. The prevalence of these narrow views has been unfavorable to the recognition of Mr. Spencer's work by a large class of the cultivators of science; and the more so, as he has been mainly occupied in the highest spheres of generalization. For this reason it is only by the comparatively small number of scientific men, who possess marked philosophic power, that his labors have been justly appreciated."

Need of Further Study of the Boulder Dam Project

The announcement comes from Washington, D. C., that no power company will bid on the electric power to be developed on the Colorado River and that the city of Los Angeles can not obligate herself to the necessary extent without exceeding her debt limit; so the so-called Boulder Dam project seems to have hit a few financial boulders at the very start.

The federal bill that made the government the sponsor for this project requires that sufficient income from the project be assured in advance, to pay not only the operating expenses but to amortize the investment within 50 years. The politicians who "engineered" the bill thought that engineers who questioned the possibility of contracting to sell the power to power companies were "all wet" and perhaps somewhat prejudiced. But the power companies of southern California now refuse to make any sort of bid for power under a contract that binds them for 50 years. They say that already they are generating power by steam at a cost that makes the hydroelectric power unattractive, and that, looking forward to a continued reduction in the cost of steam generation, they dare not enter into any 50-year contract for power. No engineer who has much knowledge as to the cost of generating power by steam would be apt to advise a power company to do anything else than these power companies have done, namely to refuse to sign a 50-year contract for hydro power.

There is one feature about such a contract that has not been discussed by the politicians who sponsored this bill. We refer to the money that will be lost by any purchaser of this power during the period when only part of it can be sold. Let it be assumed that the hydro power plant will be ready for operation 8 years hence. Some one must pay the interest charges on the investment during those 8 years, but we refer not to that big item but to the sequel to it, namely the interest charges on the unused part of the plant after operating begins. Now, under the bill, both these expenses must ultimately be paid by the power companies, cities, etc., that contract to use the plant, for the entire cost of the project must be amortized in 50 years from income received. The interest during construction will probably not be much less than 20 per cent of the cost of the project, and we would not dare advise a power company or city to estimate less than 30 per cent more to cover the "development cost" or sequel to interest during construction, for it is not probable that a full use of the plant would be reached short of 10 years after its completion. A conservative estimate for interest during construction and for subsequent interest on the unused part of the plant would be 50 per cent of its construction cost.

Should it be argued that the growth of southern California would suffice to create a demand for all the power from Boulder Dam during its construction period, the answer is that the power companies would have had to meet that growing demand every year during construction, by enlargments of their existing plants. Hence, when Boulder Dam power becomes available, either the then existing steam plants would have to be scrapped or lie idle; and, in either case, who is going to foot that bill?

As is usual when politicians "engineer" such public projects, the public finds itself in a mess. This project is a problem in engineering and business economics that should never have been made a political issue until it had been completely solved by competent experts. That it had not been completely solved was very plainly stated by the last board of engineers that reported on it. But that report was either brushed aside or misinterpreted by congressmen who were eager to be seen doing something big for their constituents before the next election. They have done something big but not exactly the big something that they thought they were doing.

The editors of "Engineering and Contracting" are of the opinion that the Boulder Dam project should be shelved until at least four entirely separate engineering boards shall have investigated the wisdom of building any such dam on the Colorado River. Where hundreds of millions of dollars are involved, it would not be extravagant to employ every eminent consulting hydraulic and power engineer in America to aid in reporting upon it. Let the "doctors disagree" as much as they may and there will be disagreement enough we may be sure—the first important thing to decide is the economic merit of this project. By securing adequate data, by threshing out the different interpretations of the data by many experts, an important board of engineers appointed by President Hoover can probably reach a correct decision.

It has been urged by the State Engineer of Arizona that Los Angeles can secure an adequate water supply from the Sierra Nevada Mountains. It has been urged by other able engineers that a gravity supply can be secured from the Colorado River by going farther north. It has been calculated that the silting up of the Boulder Dam would so rapidly reduce its storage capacity as to prevent the production of power on a large scale after a few years. It has even been suggested by engineers that a cheaper source of water for southern California is the Sacramento River.

This whole economic problem is by no means a simple one. Indeed, it is so complex that there are grave doubts whether its correct solution has yet been found.

H. P. Gillette

DISTRIBUTOR NEWS

The Distributor's Department in the Gillette Construction Group

Greetings to the Dean of U.S. Traveling Meter Salesmen, Geo. H. Carr

Forty-three years of continuous service in the meter business, as a record not of an organization but that of an individual, is a record deserving of comment.

Dean of the U. S. traveling meter salesmen is a title justly earned by long and continuous service in this field by Mr. George H. Carr, for forty-three years in the meter industry, the past twenty-six being with one company, the Worthington Pump and Machinery Corporation.

Geo. H. Carr in Charge of the Meter Department for the Worthington Pump & Machinery Corporation at Chicago

In August, 1886, Mr. Carr entered the employ of the Union Water Meter Company of Worcester, Mass., as a shipping clerk and by 1890 had advanced to that of traveling salesman. In 1898, after twelve years with this company, he severed his connection with them to travel for two years through the south for the National Meter Company. At the end of this time he entered the Chicago office of the Hersey Manufacturing Company.

In September, 1903, he was placed in charge of the central states meter business for the Worthington Pump and Machinery Corporation, where the first of September he will round out twenty-six years in the service of this company and end his forty-three years in the meter industry.

The picture presented with this story is evidence that Mr. Carr is to break this record by many more years. The Chicago office of the Worthington Pump and Machinery Corporation, where Mr. Carr is located, is at 37 West Van Buren St.

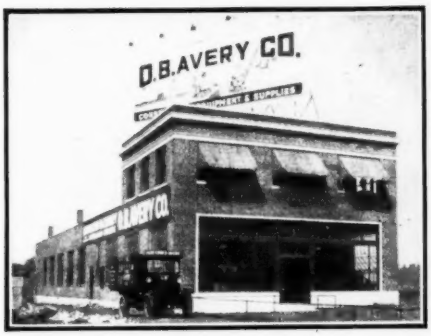
O. B. Avery Company of St. Louis to Handle Monarch Tractors

The O. B. Avery Company of St. Louis, distributors of construction equipment, have recently taken on the Allis-Chalmers Monarch Tractor line. This company has become a factor in the construction industry in the St. Louis territory, through their long established policy of cooperation with the contractor in every phase of his work. The addition of the Monarch Tractor to their already complete line of equipment is in keeping with this plan of cooperation.

In commenting on the new arrangement, one of the officials of the company said: "Allis-Chalmers Monarch Tractors are fast becoming known as outstanding tractors in power and performance due to the advanced design and development made since the Allis-Chalmers Manufacturing Company purchased the Monarch Tractors Corporation a year ago. One of the biggest points of the Monarch is its remarkable ability to keep all feet on the ground and pull—no matter how heavy the load, even under the most unfavorable conditions."

The O. B. Avery Company has a service department well equipped for handling repair work quickly and economically, under the direction of skilled tractor mechanics, and the possibility of loss of time to the contractor due to breakdowns, is cut to the minimum by carrying in St. Louis a complete stock of repair parts.

In addition to the Allis-Chalmers Monarch tractors, the Avery Company represent Northwest Engineering Company, Chicago; Chain Belt Company, Milwaukee, Wis.; Sullivan Machinery Company, Chicago; Buckeye Traction Ditcher Company, Findlay, Ohio; Butler Bin Company, Waukesha, Wis.; National Hoisting Engine Company, Harrison, New Jersey; G. H. Williams Company, Erie, Pa., and other well known lines. The St. Louis offices and



Headquarters of O. B. Avery Company, St. Louis, Mo.

warehouse is located at 1325 Macklind Avenue, where the visitor is always welcome if seeking information concerning any of the products handled by this company.

LaBour Increases Distribution Points in New York Territory

Eastern purchasers of LaBour pumps may now place their orders direct with the New York office of The LaBour Company, or with other distributors representing them.

LaBour products have previously been handled in the New York territory exclusively through Mott and McElrath Engineering Corporation. But, with a view to broadening the distribution service the exclusive feature of the arrangement with this company has been discontinued, although they continue to represent The LaBour Company.

In Mexico

The Pennsylvania Pump and Compressor Company of Easton, Pa., makers of vacuum, centrifugal and air lift pumps and compressors have appointed Wells, Fargo & Company, Express, S. A., Apartado Postal, 361, Mexico City, as distributing agents for the Republic of Mexico.

Distributor Note

Yeomans Brothers Company, Chicago, manufacturers of sewage ejectors, pumping machinery and rotary air compressors, announces the appointment of the Capitol Equipment Company, Bank of Commerce Building, Charleston, W. Va., to represent them in the Southwestern part of that state.

Capitol Equipment will handle a complete Yeomans line, which includes sewage ejectors, bilge or sump pumps, water supply pumps, general service pumps, condensation return pumps and rotary air compressors.

Frank T. Fay

Frank T. Fay, sales manager of the Asphalt Department of the Standard Oil Company of New York, Boston Division, died suddenly in his apartment at the Parker House, Boston, Sunday, May 5th.

Mr. Fay was 70 years old. He graduated from the Worcester Polytechnic Institute in 1878, and had been with Socony ever since, making a notable record of fifty years in the service of the company. He was a pioneer in the road oil and asphalt business in New England. He had been in charge of the department which he headed since its beginning.

United Tractor & Equipment Adds to Membership

The total membership of the new United Tractor & Equipment Company of Chicago has now reached forty, according to a recent announcement of its president, Mr. Milton W. Anderson. Mr. Anderson announces as new members of the organization, the Maine Steel Products Company of South Portland, Maine; the I. B. Rowell Company of Waukesha, Wisconsin, and the Northwestern Manufacturing Company of Milwaukee.

Mr. Anderson states that the announcement of the formation of the United Company for the co-operative manufacturing and marketing of a full line of machinery centering about the United Tractor, built by the Allis-Chalmers Manufacturing Company brought many requests for membership and assignment of territory.

The tractor is being sent out in carlot shipments throughout the country, and Mr. Anderson reports wide interest shown by manufacturers, distributors, dealers and customers in this product which is offered, for the 1929 season, with a full line of implements and industrial equipment, by a group of non-competitive manufacturers, to be sold through similarly functioning distributors.

A Distributor Note from Florida

Some of our readers may not know that the old firm of McDonald and Burgman, formerly located at Jacksonville, Fla., is now operating in different sections of the state as two separate companies. These two companies are now known as the McDonald Tractor-Equipment Company of Orlando and the Burgman Tractor-Equipment Company of Jacksonville.

The McDonald Tractor-Equipment Company covers the southern half of the State of Florida and Burgman Tractor-Equipment Company covers the northern half. They continue to represent the same lines as those carried by McDonald & Burgman, which include: "Caterpillar" tractors. Russel graders, Athey wheels, P&H excavating machines, Killefer equipment, Plymouth locomotives and other lines.

Burgman Tractor-Equipment Company continues to occupy the headquarters of the old company at 8 Riverside Viaduct, Jacksonville.

Two Iowa Firms Combine to Make Armco Ingot Iron Culverts

The Independence Corrugated Culvert Company of Mason City and the Iowa Pure Iron Company of Des Moines are now installing machinery and equipment for the manufacture of Armco Ingot Iron corrugated culverts and accessories at Cedar Rapids, Iowa. The plant will be operated jointly by the two companies.

It is announced that the addition of the Cedar Rapids plant, together with the plants at Des Moines and Mason City, will enable them to give prompt and efficient service to all Iowa points. The address of the Cedar Rapids plant is Box 67.

Flox Company of Minneapolis Takes On New Line of Water Level Control Equipment

Mr. C. S. Childs, general manager of The Flox Company, 430 Oak Grove, Minneapolis, Minnesota reports that they have recently taken on a new line of water level control for elevated tanks. It employs the barometric principle through use of a mercury column, exerting the pressure from the mains through needle valves, which irons out the surges and line pulsations and, accordingly, raises and lowers the mercury level, so that water levels can be maintained within a 1 foot range, if necessary.

The Flox Company have been distributors and service engineers for several years for the National Aluminate Corporation and the International Filter Company, both of Chicago.

Highway Trailer Is Going Strong in Cincinnati

A report published in the City Bulletin of the City of Cincinnati states that Highway Trailers have tremendously increased the efficiency, lowered the cost and improved the service of the department.

In 1927 the City of Cincinnati ordered eight trailers from the Highway Trailer Company of Edgerton, Wis. In 1928 an order was placed for ten, and so satisfactorily have they been working out, the 1929 order is reported to be for forty-four. The accompanying picture shows a train of trailers at work gathering refuse for the City of Cincinnati.

Train of Highway Trailers, One of Many Now Operating in City of Cincinnati

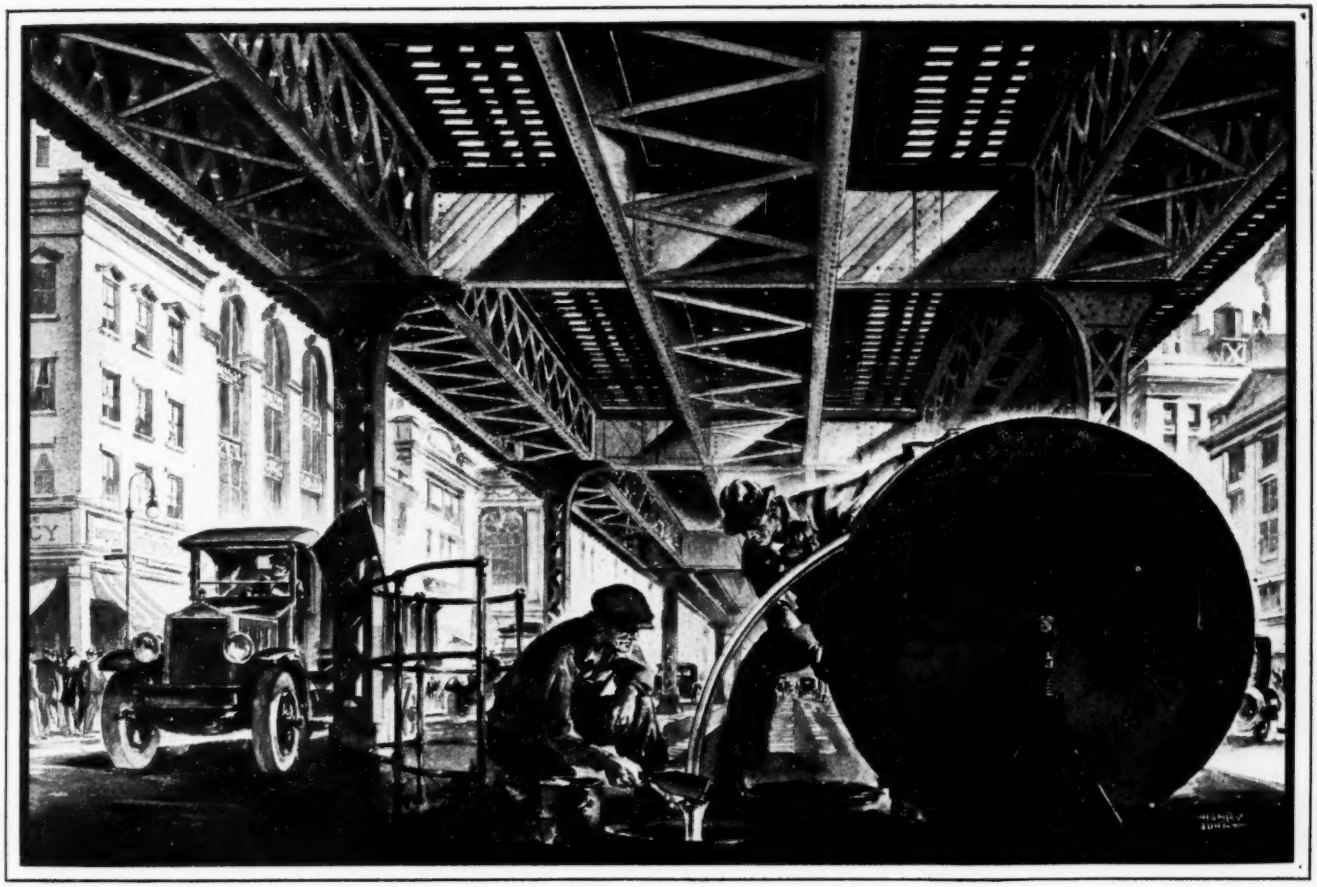
Central Iron & Steel Company's District Offices Announce Change of Address

Central Iron & Steel Company of Harrisburg, Pa., has recently announced changes in the location of its New York and Pittsburgh offices. The New York office formerly located in the Evening Post Building, is now in the new Cunard Building at 25 Broadway, Suite 516. The address of the Pittsburgh office, which was formerly 1606 Commonwealth Building, is now 1721 Oliver Building.

Central "Knobby" non-skid floor plates identifies the products of this company, which also manufactures steel plates of various kinds for the trade.

Change of Address

American Hoist and Derrick Company announces the removal of their Chicago office from the Fisher Building to 1000 Engineering Building, 205 W. Wacker Drive, and of the Pittsburgh office from 604 Chamber of Commerce Building to 901 Farmers Bank Building.



1800 conversations at once through a cable less than 3 inches thick

An Advertisement of the
American Telephone and Telegraph Company

THE earth beneath our great cities is crowded. Steam, gas, sewer and water-mains, compressed air pipes, pneumatic tube systems, telephone and telegraph cables, light, power and rapid transit conduits lie so close together that any further additions create serious engineering problems. Yet the number of telephone calls that must flash through the underground arteries of great cities is steadily increasing.

The challenge to the scientific minds of the Bell System was to find a way for more conversations in existing conduits. Fifteen years ago, the pride of the System was a cable containing nine hundred pairs of wires. Then by many improvements a cable of twelve hundred pairs was perfected. It was rightly considered a scientific triumph.

Today, cables containing eighteen hundred pairs of wires are in service and these cables with every wire insulated are only two and five-eighths inches in diameter, one-half as large as the first nine hundred-pair cable. Eighteen hundred conversations at once—six hundred more than before—can now pulse through this two and five-eighths inches of cable.

There is no standing still in the Bell System. Better and better telephone service at the lowest cost is the goal. Present improvements constantly going into effect are but the foundation for the greater service of the future.

"THE TELEPHONE BOOKS ARE THE DIRECTORY OF THE NATION"

SERVICE EXCHANGE
For
Manufacturers or Distributors

Editor's Note.—From time to time we receive letters from distributors wishing to be put in touch with manufacturers of certain lines of equipment, or from manufacturers seeking representatives for their products. Items of this kind will be published and names and addresses furnished interested persons upon request.

New Lines Wanted

Equipment distributor in Pacific Northwest desires line of road building equipment, structural building equipment, dump bodies and truck hoists.

Distributors of contractors' and builders' machinery and equipment are seeking line of road forms, road finishers, batcher plants, clamshell buckets and drag line buckets, for Northern California territory. Now stocking equipment for several well known machinery manufacturers.

Man experienced in selling road building machinery to state highway departments, contractors, county and city officials, would like to make connection as district representative or branch manager. Located in Ohio, but would consider other territory.

Road machinery distributor would like to secure exclusive sales rights for state of Mississippi for line of automatic or self-loading wheeled scraper.

A Michigan distributor, with many years' experience, representing at this time prominent manufacturers of pumping machinery, offers the services of an established representative to manufacturers needing increased facilities in this region.

Manufacturers' representatives located in New York would like to add line of heavy contractors' equipment of established reputation, other than the lines now handled by them. They would like exclusive sales rights for such equipment.

New York company would like to represent manufacturers not already established in eastern market, or who would like to make a change in their sales arrangements.

Machinery company in the east is interested in representing established lines of road machinery, with the exception of graders.

Civil engineer located in Porto Rico would like to hear from manufacturers desiring sole representation for their products in Porto Rico, Santo Domingo and Venezuela. Machinery for highway construction, purification plants, steel for buildings or bridges or other building materials and contractors' equipment.

A man of many years' experience in the machinery business in the south would like to make a business connection for the sale of road machinery equipment.

Eastern Distributor handling Brick and Clay Products, and similar commodities, would be pleased to get in touch with manufacturers desiring eastern representation.

Machinery distributor established in Porto Rico and Santo Domingo would be pleased to make arrangements to take on new lines in these territories.

A contractor's superintendent, located in Florida, would like to represent some road equipment manufacturers in his territory.

District respresentative for sanitary engineering specialties would be interested in any line in the water works field. Has had experience in field of filters, softeners and water meters.

Representatives Wanted

Manufacturer of hoisting machinery and air compressors has open territory in New York and New England states for aggressive distributor.

Manufacturer of excavating equipment desires to build up distribution organization throughout the country.

Manufacturer of non-clogging sewage pumps, both horizontal and vertical, as well as water works pumps suitable for municipalities of 50,000 or 60,000 people, is interested in securing additional sales representation.

Manufacturer of two cycle oil and gas engines in sizes from 30 to 125 H. P. adaptable for water works and many industrial purposes, wishes to establish points of distribution throughout the country.

New York corporation wishes to establish agencies throughout the country, prefer men specializing in heating and ventilating equipment.

A manufacturer of paving expansion joints is looking for distributors for northern California territory.

New York corporation, producing complete line of coal-tar products, wishes to make dealer connections throughout the country.

Manufacturer has some attractive territory available for distributors for complete line of generators, and centrifugal, diaphragm and piston pumps.

Manufacturer of metal lath, corner beads, channels and reinforcing mesh desires to secure distributors for products in the Southwest and Middlewest.

Manufacturer of building specialties wishes to establish distributors throughout the country. Manufactures concrete reinforcements and metal lath; Reed clips, form spacers, continuous column tie, continuous chair stirrup, beam bar spacers, slab bar spacers, continuous Hi-chair, continuous anchor slot, sleeping spacing anchor, humpback hairpin clip, lath hanger, stone anchors, straight wire lengths and special wire lengths.

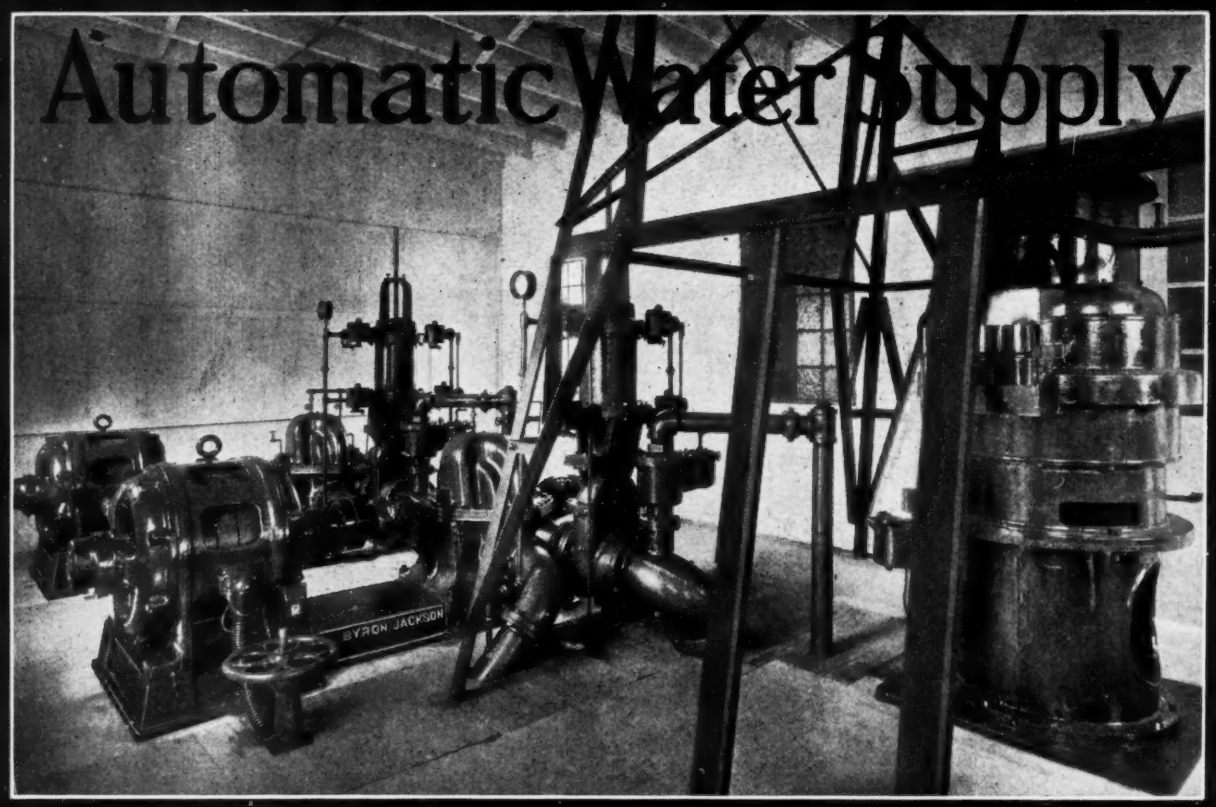
Manufacturer of threadless pipe couplings and tees, with rapidly growing business, is seeking additional representatives.

Manufacturer of metal tie and spacer wishes to establish distributing points throughout the country.

Manufacturer of mechanical spreaders for cover material desires representation by organizations covering entire states. Several desirable states are still open. Number of inquiries now on hand for spreaders require immediate follow up.

Manufacturer of automatic dipper trip, adapted to any type shovel (steam, gasoline, diesel, electric, etc.); with rapidly growing business, is seeking additional representatives.

Nichols Copper Company who are building new tank house at El Paso, Texas, have let the contract for the electrolytic tanks and foundations to the Cement-Gun Construction Company of Chicago. This construction company have for years made a specialty of concrete electrolytic tanks.



Reliable Pumps for Water Works

BYRON JACKSON Service PUMP MFG CO.

Byron Jackson automatic water supply pumps are especially adapted for municipal purposes. In the above illustration is shown a Byron Jackson Deepwell Turbine pump that lifts water from underground sources, supplying the two Byron Jackson Multiplex high pressure booster pumps on the left. These pumps are noted for long life and trouble-free operation. Their completely automatic control is introducing a new era in water works practice.

SINCE 1872

BYRON JACKSON PUMP CO.

Factories: BERKELEY, Los Angeles, Visalia, Calif.

Branches: San Francisco, Portland, Salt Lake, Dallas, Phoenix

CHICAGO and NEW YORK

BYRON JACKSON

CENTRIFUGAL PUMPS FOR EVERY SERVICE

House Magazines

Editor's Note: This column is published every now and then. Many most attractive and interesting house magazines come to our desk from time to time, and we take this method of acknowledging them.

The Blue Band Bag.—This little leaflet is given the first place because it is so new and shining—Volume 1, No. 1. It isn't very big, but like so many small things very attractive. It is published by the North American Cement Corporation, 285 Madison Avenue, New York "for the purpose of acquainting you with its products and its policies." Thomas Dreier is the editor. The short items are easily read, but each one contains an idea worth thinking about. We quote one sentence: "Start right where you are with what you have."

The Mueller Record.—In contrast to Volume 1, No. 1 of the previously mentioned booklet, we present Volume XVIII, No. 201 of the Mueller Record, published by Mueller Company, Decatur, Illinois, of which C. N. Wagenseller is the editor. This is a 40 page magazine filled with items both grave and gay. The central article in the book is a description of the water works plant at El Centro, California. Another item of general interest is the illustrated description of Chicago's Gold Medal Building, known as 333 Michigan Avenue. It goes without saying the annual convention of the American Water Works Association was given due space.

The Labor Saver.—This 24 page booklet appears as issue No. 165 for the Stephens-Adamson Mfg. Co. of Aurora, Illinois. It is devoted to the "promotion of labor saving methods" and has as its editor Mr. C. H. Adamson. The lead off in this issue is devoted to the $5,000,000 addition to the Virginia Electric and Power Company plant at Norfolk, Virginia, enlarged to include 30,000 KW generator, 12,000-ton coal storage yard and the installation of Stephens-Adamson coal unloading and handling equipment. Booklet contains many illustrations and cross-sectional drawings explaining possibilities of the National material handling systems.

Bores & Strokes.—The Schramm, Inc., representative arrived with its usual punctuality in May, and contained a very interesting picture of a booth at a Fair in Czecho Slovakia, where the "Schramm" compressors seemed to be giving an excellent account of themselves.

Good Roads.—Published by the Good Roads Machinery Company at Kennett Square, Pennsylvania is now half way through its second year. This little paper is filled with distributor news concerning Good Roads equipment.

The Wood Hoister.—From Wood Hydraulic Hoist & Body Co., Detroit, Michigan, for May, contains some interesting information concerning profitable transportation of Wet-Mix.

The Dump Truck on the Job.—The organ published in the interest of the many users of dump trucks by the Hydraulic Hoist Manufacturing Company of St. Paul, devotes its center pages to a description of the New Eastern State Penitentiary at Graterford, Pa.; buildings more interesting from the viewpoint of those on the outside looking in, than of those on the inside looking out. This article is contributed by Mr. Leonard Rodenhausen of the firm Rodenhausen Sales & Service Company.

Caterpillar Magazine.—Another regular monthly visitor, representing the Caterpillar Tractor Company of San Leandro, California, brought with it its usual interesting "round the world views." There seem to be few places where men have been that Caterpillar has not been, and many places where men would not find the going so good but for the aid of the Caterpillar.

Shovel News.—The June issue of this twenty page booklet, published by Link-Belt Company, 300 W. Pershing Road, Chicago, contained several very interesting articles on recent construction work. Work on bridges and sea walls at Long Beach, California, sewer work in Kansas and levee construction along the Mississippi, makes interesting reading, and there are several others just as good in this one little booklet.

Monarch Track-Type.—Issue No. 3 of Volume 1 of this magazine of Allis-Chalmers Mfg. Company of Milwaukee, Wisconsin, pictures the Monarch at work on roads, logging, earth moving, working on the farm, and engaged in other peaceful and profitable occupations.

Meet J. A. Hanratty, Vice-President of Pioneer Gravel Equipment Co.

Friends of Mr. J. A. Hanratty have furnished the picture which is presented here, believing it to be the only one in existence, with the possible exception of one "way back when"—and even this one, to do him full justice, should show him to be about ten years older.

Just why Mr. Hanratty decided to become a gravel equipment sales engineer is something of a mystery, although rumor has it that gathering gravel for bird cages in his youth first lead to quantity production and later he just naturally took on the whole scheme of crushing, screening and loading plants. He says the bird cage business had nothing to do with the case, and that the Russell Grader Company did the pioneering in gravel machinery and that he joined them in 1919, specializing in the gravel equipment line and traveling all over the United States and Canada in the course of this work.

When the Russell Grader Company recently merged with Caterpillar Tractor, J. A. Hanratty, the Ellertsons, Brunsdale, York and the rest of the Russell Grader enthusiasts, together with W. H. F. Thompson, who report

J. A. Hanratty, Vice-President Pioneer Gravel Equipment Mfg. Co., Minneapolis, Minn.

says became interested in gravel through wearing low shoes, bought out this end of the Russell Grader business and incorporated under the name of Pioneer Gravel Equipment Manufacturing Company of Minneapolis.

Distributors and service stations have been established all over the United States and Canada and a new plant in Northeast Minneapolis, with 36,000 sq. ft. of floor space, has just been completed.

J. A. Hanratty's principal hobby is work, and with him work means gravel equipment machinery installation to fit every type of road building requirement. To accomplish this he is traveling so much over the face of the earth, advising with contractors and municipalities regarding their gravel equipment needs, that it is reported he calls his two little girls, aged 6 and 3½, "Pat" and "Jack," so much does he think of the problems of Pat and Jack at their road building work.

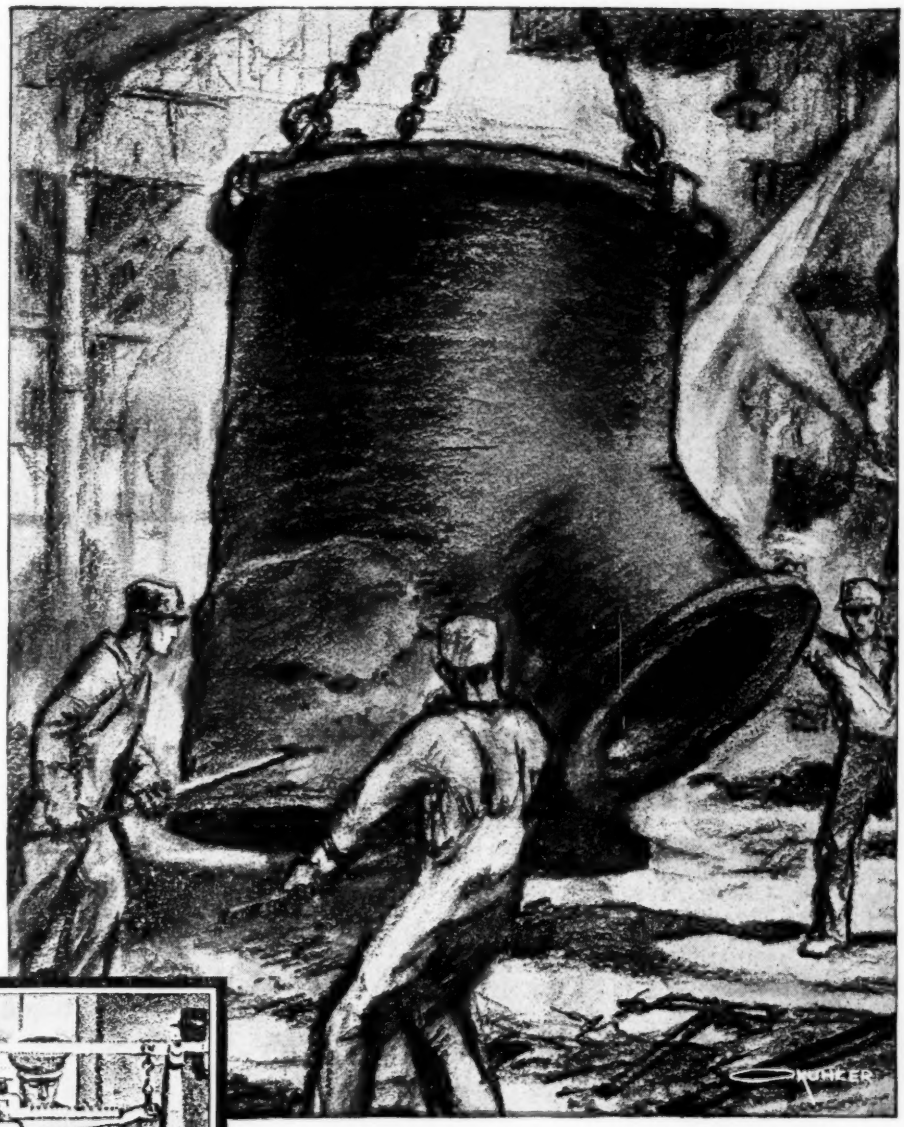
J. A. Hanratty is worth meeting.

Balzer Machinery Celebrates Birthday Party

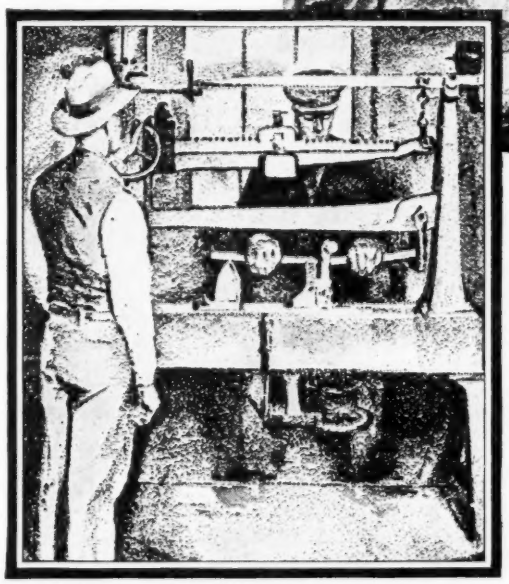
Although Mr. R. L. Balzer, manager of the Balzer Machinery Company has had over twenty years experience in the Portland territory in selling machinery, their organization has only recently celebrated its first birthday.

Before the organization of the Balzer Machinery Company, Mr. Balzer was long connected with the Clyde Equipment Company, and his experience at the head of that company, gave him many contacts with the trade.

Balzer Machinery Company is located at 267½ Oak Street, Portland, Oregon, and specializes on Gardner-Denver air equipment, General Excavator gasoline shovels, Wheeling roller bearing crushers, Owen clamshell buckets, and Ohio locomotive cranes.



In the modern foundry, cast iron specimen bars 26″ x 2″ x 1″ are tested from each run of metal. The bars when placed flatwise upon supports 24 inches apart must sustain a load of 2000 pounds at the center and show a deflection of not less than .30 inches before breaking.



CAST Q IRON

The "Q-check" symbol shown above has been adopted as the trademark of The Cast Iron Pipe Research Association. Insist on this "Q-check" mark when specifying cast iron pipe for gas, water, sewer, or industrial service. For complete information write to The Cast Iron Pipe Research Association, Thomas F. Wolfe, Research Engineer, Peoples Gas Building, Chicago.

SCIENCE and invention have been diligently employed in the ancient but alert industry of cast iron pipe manufacture. There are no wasted minutes or motions in the modern cast iron pipe foundry. The work proceeds with the smoothness of practised team-work. Old-time foundry men would doubtless be amazed to observe the many appliances used today to speed the production and assure the uniform quality of modern cast iron pipe.

* * *

The Cast Iron Pipe Research Association is a service organization of leading pipe founders, formed to promote the scientific improvement and proper use of Cast Iron Pipe. Pipe bearing the Association "Q-check" mark may be obtained from the following: American Cast Iron Pipe Co., Birmingham, Ala.; James B. Clow & Sons, 219 N. Talman Ave., Chicago, Ill.; Donaldson Iron Company, Emaus, Pa.; Glamorgan Pipe and Foundry Co., Lynchburg, Va.; Lynchburg Foundry Company, Lynchburg, Va.; National Cast Iron Pipe Company, Birmingham, Ala.; United States Cast Iron Pipe & Foundry Company, Burlington, N. J.; Warren Foundry and Pipe Company, 11 Broadway, New York City.

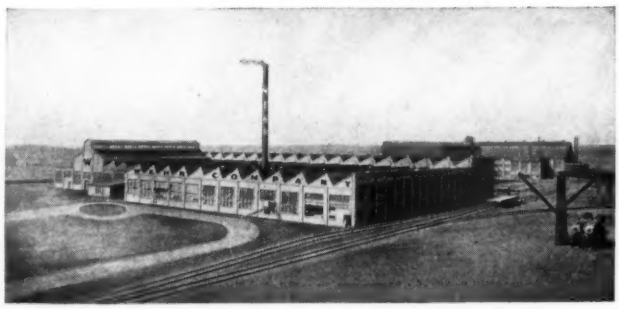
Copyright 1929, C. I. P. R. Ass'n.

CAST IRON PIPE

Wehr Company in New Home

Popular demand for the Wehr One-Man Power Grader, and the other Wehr products, has been so great that Wehr plant facilities required a recent expansion of large dimensions.

The new Wehr plant is located at Cudahy, Wis., a suburb of Milwaukee. The building is of modern brick, saw-tooth construction, and is exceptionally light and airy at all times. The outside dimensions are approximately 450 ft. x 360 ft., with about 125,000 sq. ft. devoted entirely to the manufacture of One-Man Power Graders, road rollers, and other Wehr products.



New Wehr Plant at Cudahy, Wis.

Side track facilities at the outside loading platform will accommodate eight to ten freight cars. Trackage inside the building will accommodate five freight cars for loading. Overhead crane facilities greatly assist in the speeding up and efficiency of production. Many thousands of dollars have been spent in the most modern equipment for the machine shop.

An efficient material-handling system has been established, whereby production per day has been increased over 400 per cent.

Office efficiency is increased through the establishment of personnel in a large area of "daylight" floor space.

Orders for Wehr equipment are being filled in rapid succession, and daily shipments are being made to every part of the country.

New and Up-to-Date Quarters for Penn Machinery Co.

Who isn't justly proud of new possessions? The H. O. Penn Machinery Company of New York City is no exception, and they extend a cordial invitation to the trade to visit them at their new headquarters at the Port Morris Terminal, 140th St. and East River, Bronx, New York.

The general offices as well as the warehouse are located at the new address, where ample facilities are available for the enormously increased business now being handled by the company. In making the change, the interests of the many customers have been kept in mind, with a view to giving the highest possible service. No expense has been spared to make the new facilities second to none, and with the large stock of equipment now carried, and the service arrangements, the officers believe they are in a position to meet any demand. A most complete service and parts stations will be maintained and 24 hour service will be rendered. The new location affords about 25,000 sq. ft. of warehouse space, all under cover, with railroad siding and literage delivery.

No change is announced in the personnel of the organization, and the officers are all well known to the trade. Mr. Hamilton O. Penn, from whom the firm takes its name, continues as president; Mr. Frank I. Ginsberg, vice-president, and Mr. E. Gwynn Robinson, secretary and treasurer.

In addition to the established lines that have been carried for several years, namely: Byers crane shovels; Rex pavers, mixers and pumps; Butler steel bins and weighing devices; Hotchkiss steel road and sidewalk forms; Archer mast hoists, and O. K. hoists and compressors, the company has now assumed the agency for the International Harvester tractors and accessories.

If in the neighborhood of the new headquarters, stop and see Penn Machinery Company, where you will receive a hearty welcome.

F. O. Weber to Represent Fusion Welding in Pennsylvania

The Fusion Welding Corporation, 103rd Street and Torrence Avenue, Chicago, manufacturers of welding equipment and supplies, announce the appointment of Mr. F. O. Weber, 229 Boulevard Des Allies, Pittsburgh, Pennsylvania, as sale manager for the Pittsburgh district.

Mr. Weber has been identified with the welding industry for a great many years.

"Inland Empire"

The recently organized Construction Equipment Company of Spokane, Washington, has announced the entire Inland Empire as their territory for the sale of contractor's equipment. For those of our readers who may not know just what territory is meant by this term which is well known in the Pacific Northwest, "Inland Empire" is used to designate the territory within a radius of about 200 miles from Spokane. It might be described as that part of the country bounded by the Canadian line on the north, the Oregon State line on the south, the Cascade Mountain Range on the west and the Montana-Idaho state line on the east.

Introducing Kratz & McClelland, Inc.

Mr. Carl E. Kratz, who has been identified with the construction equipment industry on the western coast for the past 20 years, has formed a partnership with R. T. McClelland, to be known as Kratz & McClelland, Inc.

The office and warehouse of this equipment company is located at 522 Bryant St., San Francisco, Calif. They are representing such well known manufacturers as the Ransome Concrete Machinery Company, Novo Engine Company and Chausse Oil Burner Company. Stocks of the various products of these manufacturers are carried at the warehouse, insuring prompt delivery and service.

Distributor News extends their best wishes to the new organization and is anticipating some good distributor stories from them.

Announcement

The Lincoln Electric Company, Cleveland, Ohio, manufacturers of "Stable-Arc" welders and "Linc-Weld" motors, announces the recent appointment of new district sales representatives. B. W. Brown has been advanced to district sales representative with headquarters at Milwaukee, Wis.

G. O. Forseth, formerly a sales representative at Detroit, Michigan, has been promoted to district sales representative with headquarters at Minneapolis, Minn.

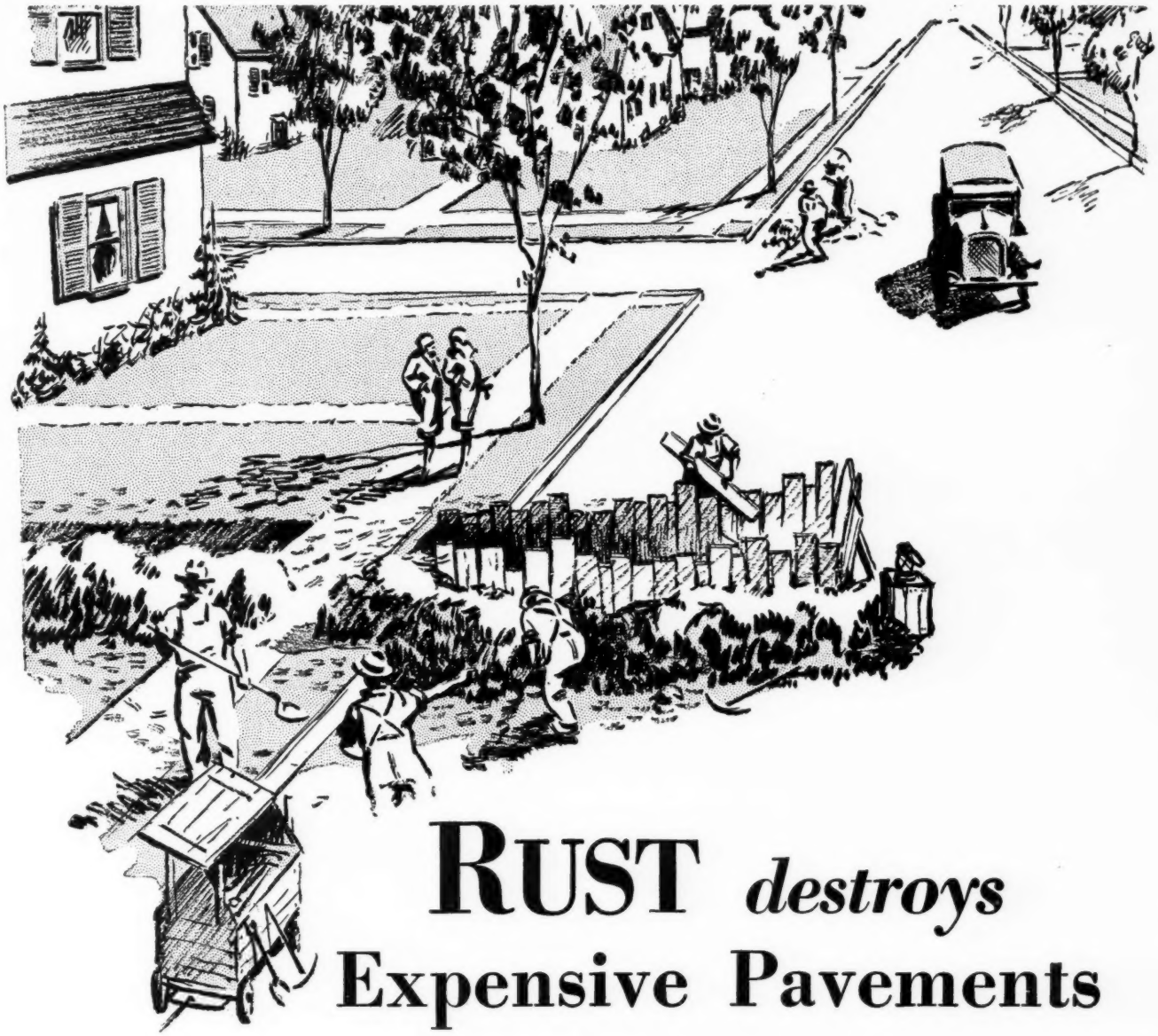
A Change of Name

The Cornell Supply Company located at 7th and P Sts., Lincoln, Nebraska, have changed their firm name to the U. S. Supply Company. This organization represents the Chicago Pump Company.

The Chicago Pump Company announces several additions to their sales representation. Mr. W. H. Hornbuckle, manager of the Southern Sales Company at Memphis, will represent them in several states in the south. Mr. Ray Trethaway has joined the Detroit office, where he will handle engineering service. Mr. Sidney Steiner, after spending considerable time at the Chicago Pump factory, has entered the New York office, where he will have charge of pump detail.

P. S. Lord, 406 Weatherly Building, Portland, Oregon, has joined the sales staff of the Chicago Pump Company, with headquarters at address given.

The Wagner Electric Corporation of St. Louis, Missouri, announces the appointment of Mr. L. G. Tandberg as branch manager of its Los Angeles sales office.



RUST *destroys* Expensive Pavements

EVERY city, town and village boasts of its streets and sidewalks. Citizens point with pride to such improvements. When water service pipes which carry the water into the homes are made of corrodible metal they soon become rust clogged. The result is that when the home owner turns on a faucet only a tiny trickle of reddish water drips. The rusting service pipe soon bursts. Streets and lawns must then be torn up so that necessary repairs can be made. All of which results in a heavy financial burden to the taxpayer.

Copper or Brass water service pipe cannot rust. Municipal governments never have to tear up expensive pavements to make repairs and replacements.

Full information on the advantages of Copper or Brass pipe will be furnished you by this Association without cost or obligation on your part.

COPPER & BRASS
RESEARCH ASSOCIATION
25 Broadway, New York

Midwestern Office:	*Canadian Office:*	*Pacific Coast Branch:*
Landreth Building	67 Yonge Street	Architects Building
St. Louis, Mo.	Toronto, Ont.	Los Angeles, Cal.

Municipal Officials
Contractors
Engineers

Valuable Information Yours for the Asking

Write Now

Catalog Service

Useful Equipment Information

Watch these trade announcements for new and improved equipment

By writing the manufacturers named and mentioning this magazine, copies of the following catalogs will be sent to you without obligation

TRADE PUBLICATIONS

Street and Parking Signs.—A folder from the A. D. Joslin Manufacturing Co., Manistee, Mich., describes the Joslin line of weatherproof street signs. Standard street markers and parking and zone signs are illustrated. Joslin street signs are guaranteed to be readable for 10 years. The makers will be glad to provide you with a folder.

Motor Sweepers.—The Austin motor pick-up sweeper is described in Catalog No. 8, issued by the Austin Manufacturing Co., 400 North Michigan Ave., Chicago, Ill. This is a sprinkler-sweeper with oscillating gutter broom and rear pick-up broom. The catalog contains specifications and detailed drawings, photographs and cross-sections of the sweeper. The manufacturers will be pleased to furnish you with a copy.

Municipal Castings.—Clark municipal castings, service boxes, meter boxes and valve housings are described and illustrated in bulletins of the H. W. Clark Co., Mattoon, Ill. An inquiry will bring information on all Clark products.

Garages.—"Modern Garages" is a 24-page booklet issued by the Portland Cement Association, describing and illustrating multi-story reinforced concrete garages in cities all over the country. Interior and exterior views of the structures are shown. Most of the garages are of the ramp type. There is a brief statement of the essentials of garage design. Architects everywhere should be interested in securing copies of this booklet. Write to the Portland Cement Association.

Industrial Flooring. — The Wright Rubber Products Co., Racine, Wis., will be pleased to send you copies of their latest folders describing Wright rubber-block industrial flooring. Examples of Wright installations are shown, and a color index is provided.

Files.—Write to Heller Brothers Co., Newark, N. J., for a folder describing Vixen files. Flat, flexible and half-round files are illustrated. Each tooth of a Vixen file is individually milled and undercut, with the result that the action of the file is shearing rather than scraping. The manufacturers will be glad to discuss your filing problems with you.

Finishing Materials—Information on materials of all kinds for structural repairs and plant maintenance will be supplied by the Stone & Tar Products Co., 97 South Sixth St., Brooklyn, N. Y. Among the products described are waterproofing cement, concrete hardener, transparent spar oil, cement paint, steel coating, shingle stain and ornate-stone textural coating.

Air Compressors and Tools.—Write to the Ingersoll-Rand Co., 11 Broadway, New York, N. Y., for the latest bulletin describing Ingersoll-Rand portable air compressors and tools. Machines are available for rock drilling and pavement breaking, trench digging and backfilling, hoisting and hauling, grinding and surfacing, riveting, sheet pile driving, spray painting, tie tamping, etc. A table is included, giving the number of Ingersoll-Rand tools that each size of Ingersoll-Rand portable compressor will operate in general service.

Omicron.—A profusely illustrated and charted discussion of the deterioration of concrete floors through traffic and chemical disintegration has been published by the Master Builders Co., Cleveland, Ohio. It is a 28-page book entitled "The Fifth Ingredient." It is the claim of the authors that chemical agents, present everywhere, hasten the deterioration of concrete under traffic even where chemicals are not apparently present, but that this deterioration can be checked. The rapid deterioration of concrete floors in dairies, sugar refineries, paper mills, etc., according to the facts and illustrations in this book, is only an exaggerated example of the disintegrating action to which all concrete is subject. The effect of mechanical wear is also discussed. Free copies of "The Fifth Ingredient" may be secured from the Master Builders Co., manufacturers of concrete hardeners, waterproofings and allied technical products, 7016 Euclid Ave., Cleveland, Ohio.

Drill Steel Sharpener.—The Sullivan Machinery Co. has just published a new bulletin on its light model drill steel sharpener, class "C." This bulletin, No. 72-N, contains 16 pages and is fully illustrated with details of the sharpener and pictures of the machine at work. This sharpener is suitable for work on hammer drill bits and shanks for the lighter drills, and is also effective for making pick and chisel point bits for concrete breakers and similar tools. As in all Sullivan sharpeners, the "all-hammer" principle of upsetting and swaging the steel is employed, thus retaining the original quality of the steel and increasing its toughness and resistance to wear. Copies of this new bulletin will be sent upon request to the Sullivan Machinery Co., 400 North Michigan Ave., Chicago.

Road Graders.—Write to the Austin-Western Road Machinery Co., 400 North Michigan Ave., Chicago, for the latest folder describing Western graders and scarifiers. A line of graders adapted to all conditions is presented. A copy of the folder will be sent you upon request.

Wrenches. — The Heller "master-wrench" is described in a folder issued by the Heller Brothers, Co., Newark, N. J. This is a ratchet-action wrench made of chrome vanadium steel. The wrenches are made in sizes ranging from 6 to 14 in. in length, with smooth jaws for nuts and bolts and with pipe jaws for use on pipe. Write to the manufacturers for this circular.

Street Signals. — Write to the Rochester Street Signal Co., 400 Ward Building, Rochester, N. Y., for a folder describing "Monroe" and "Simplex" street signs. The "Monroe" unit is the only one in the market that employs no screws, nuts or bolts in the assembling. The fittings are made of aluminum. The sign plates are enameled. Inquiries are invited.

Rotary Soil Screens.—A recent folder describes four models of the Converse rotary soil screen, manufactured by the F. S. Converse Co., Inc., Johnson City, N. Y. Data are presented to prove that a rotary soil screen pays for itself in one season on an 18-hole golf course. The bulletin contains prices of complete units and accessories. The manufacturers will be glad to send you a copy.

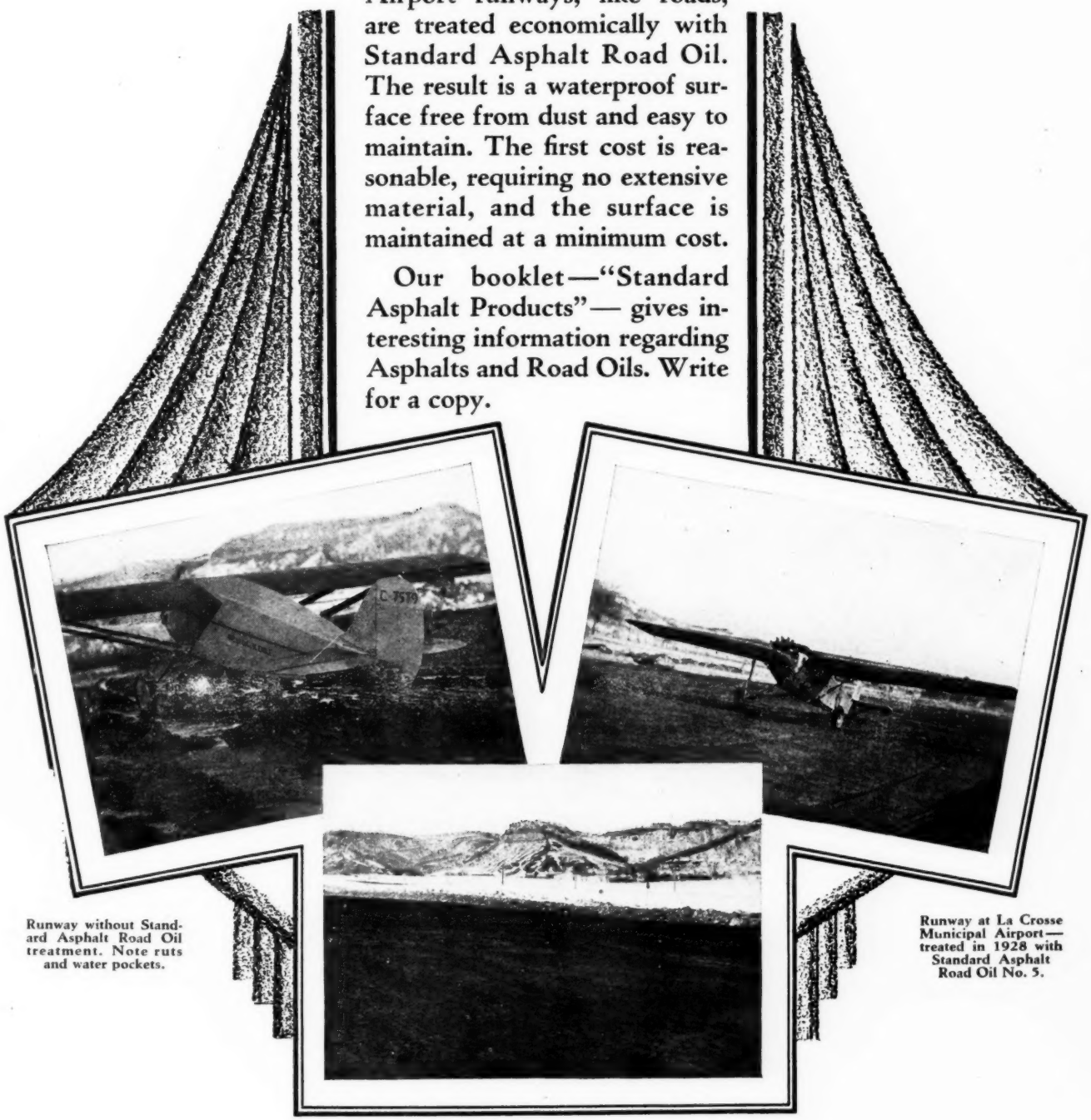
Good Roads Equipment. — Recent publications of the Good Roads Machinery Co. include booklets describing the Good Roads "motograder," the Good Roads senior roller, the Good Roads "autograder" and the Good Roads cold application oil distributors. These booklets contain detailed descriptions and specifications, along with photographs of the equipment in action. Write to the manufacturers for copies.

Wallace & Tiernan.—We have had the pleasure of receiving the latest Wallace & Tiernan bulletins, by title "Vacuum 'Type MSV' Chlorinator," "The Sanitation of Swimming Pools," "Chlorine in Sewage Purification," "Chlorination of Small Water Supplies" and "Wallace & Tiernan Highway Flashers." The use of chlorine in the disinfection of sewage is increasing, and a perusal of the Wallace & Tiernan bulletin dealing with this application of their products is recommended to all

AIRPORT RUNWAYS TREATED WITH STANDARD ASPHALT ROAD OIL

Airport runways, like roads, are treated economically with Standard Asphalt Road Oil. The result is a waterproof surface free from dust and easy to maintain. The first cost is reasonable, requiring no extensive material, and the surface is maintained at a minimum cost.

Our booklet—"Standard Asphalt Products"— gives interesting information regarding Asphalts and Road Oils. Write for a copy.



Runway without Standard Asphalt Road Oil treatment. Note ruts and water pockets.

Runway at La Crosse Municipal Airport—treated in 1928 with Standard Asphalt Road Oil No. 5.

Note smooth surface with complete absence of ruts, holes and water pockets.

STANDARD OIL COMPANY (*Indiana*)

General Offices: 910 S. Michigan Ave. CHICAGO, ILLINOIS

ILLINOIS	INDIANA	IOWA	MICHIGAN	WISCONSIN	MINNESOTA	MISSOURI
Chicago	Evansville	Davenport	Detroit	La Crosse	Duluth	Kansas City
Decatur	Indianapolis	Des Moines	Grand Rapids	Milwaukee	Mankato	St. Joseph
Joliet	South Bend	Mason City	Saginaw	Green Bay	Minneapolis	St. Louis
Peoria	KANSAS	Sioux City	S. DAKOTA		N. DAKOTA	
Quincy	Wichita		Huron		Fargo	Minot

218

engineers and officials dealing with the and a perusal of the Wallace & Tiernan highway flashers are dry battery operated. The booklet includes specifications, drawings and typical layouts. A traffic engineer in the employ of the company is at the service of all municipalities having traffic problems. The Wallace & Tiernan publications are attractive typographically, delighting the eye at the same time as the mind is instructed by the subject-matter. Wallace & Tiernan Co., Inc., Newark, N. J., will be glad to send you copies.

Headley Grade Crossings.—Headley grade crossings and platforms for steam and electric railroads are described in a booklet issued by the Headley Good Roads Co., Franklin Trust Building, Philadelphia, Pa. "Headley No. 1" is an emulsified asphalt cement. Used to bond crushed stone or other suitable aggregate, it makes a safe, economical and durable crossing or platform. The booklet gives directions for mixing and applying. The manufacturers will be pleased to furnish you with a copy.

Core Drills.—Circular No. 29-B, issued by Sprague & Henwood, Inc., 221 West Olive St., Scranton, Pa., describes core drills and supplies manufactured by this firm. Of particular interest is a pavement core drill, arranged for mounting on a motor truck, making it convenient for the use of highway engineers. A copy of the circular will be sent upon request.

Industrial Engines.—Van Blerck industrial engines are described in a recent folder issued by the Light Manufacturing & Foundry Co., Pottstown, Pa. Pump installations powered by 4, 6 and 8-cylinder engines are illustrated. The manufacturers will be pleased to send you one of the folders, and they offer you the services of their engineering department.

Mine Scraper Hoist.—The American Hoist & Derrick Co. has just issued an illustrated folder which describes and illustrates their "American" mine scraper hoist. The hoist is operated by compressed air. The cylinders are of the 7 x 8 in. size. With an air pressure of 65 lb. at the throttle, the hoist has a single line pull of 4,300 lb. The hoist is very compact, being only 3 ft. high and 4 ft. 8 in. long. Some of the outstanding features of the hoist are piston valves, band-type frictions, cast-steel cut stub tooth gears and Alemite lubrication all over. For a copy of this pamphlet, address the American Hoist & Derrick Co., 63 South Robert St., St. Paul, Minn.

Toncan Iron.—The use of Toncan iron in perforated, corrugated iron underdrains is described in booklets recently published by the Canton Culvert & Silo Co., Canton, Ohio, and the Toncan Culvert Manufacturers' Association, Massilon, Ohio. Both booklets deal with the general problems of drainage, and contain technical and practical discussions of the design and application of Toncan copper molybdenum iron drains. Toncan iron is manufactured by the Central Alloy Steel Corp., Massilon, Ohio.

Mapping Instruments. — Miner & Leathermen topographic and traverse instruments for platting topographic field notes and traverses are described in a recent folder. It is stated that, with the aid of the topographic instrument, eleven and one-half days of field topography were platted and contours drawn, in eight and one-half hours. Write to Miner & Leatherman Co., 58 West Pearl St., Coldwater, Mich., for a copy.

Rotary Positive Blowers.—The P. H. & F. M. Roots Co., of Connersville, Ind., has just issued a new 16-page bulletin, No. 22-B1, on low-pressure type rotary positive blowers. The bulletin covers the new Roots modernized blowers, equipped with Timken, SKF or Hyatt bearings. The bulletin includes a dimensioned print, a table of sizes giving speeds, capacities and horsepowers at various pressures and a brief review of various types of pumping units. Bulletin 22-B1 replaces the former bulletin 1011 issued by this company, and is so constructed as to make it a valuable addition to the large Roots catalog covering pumps, meters and blowers. Write to the manufacturers for a copy.

Pioneer Gravel Equipment.—The Pioneer Gravel Equipment Mfg. Co., with offices in Minneapolis, Minn., will be pleased to send you literature and catalog describing the Pioneer gravel equipment line, which features portable screening, crushing and loading plants. The Pioneer line includes eleven sizes of crushing plants and five distinct sizes of gravel loading plants. In addition, the line includes draglines, shaker and revolving screens, belt conveyors, in three widths and several sizes of gravel storage bins.

Vertical Gas Engines.—Bulletin 782 of the Chicago Pneumatic Tool Co. describes the type RHG 75 vertical gas engines manufactured by this company. This is really a diesel engine adapted to the use of gas as a fuel. The booklet contains dimensioned drawings and photographs. The manufacturers will be glad to send you a copy. This company maintains an engineering department placed at the service of the customer to assist in solving difficulties and to make recommendations. Service branches are widely distributed and skilled service men are quickly available.

Bilge Pumps.—Bulletin B-3400 of the Yeomans Brothers Co., 1433 Dayton St., Chicago, presents the Yeomans line of heavy-duty bilge pumps. These pumps are built in single and duplex types and can be furnished with regular equipment or with a number of special features such as slow-speed motors, high water alarms, pipe casings for floats, automatic oil economizers, etc., which increase still further the reliability and durability of the machines. Drawings and data tables are included. Write to the manufacturer for a copy.

Servicised Products.—Catalog No. 12 of the Servicised Products Corp. has just come from the printer. This book deals with expansion joints in a rather brief but fairly complete manner, and treats exhaustively of other Servicised products of later development. Most important of these are fibrated asphalt planking, industrial flooring, rail filler, highway crossings and protection course for waterproofing. Readers interested in any way in waterproofing protection materials for use in connection with concrete construction for any purpose will find much that is interesting in the new Servicised catalog. Servicised expansion joints are treated completely in Servicised catalog No. 11, which is also available.

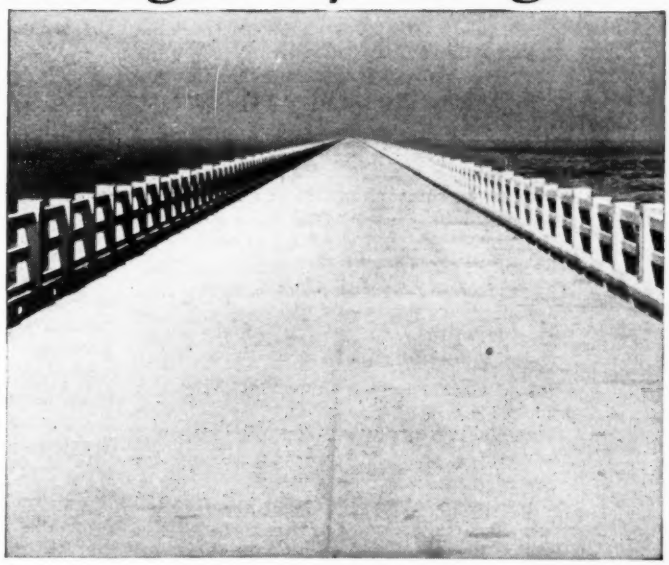
Arc Welding.—The very wide range of uses of electric arc welding in the maintenance field is shown pictorially in a publication recently released by the Westinghouse Electric & Manufacturing Co. Because of the great interest shown in the fabrication of structures by arc welding, the original application of the electric arc has been somewhat overlooked. This folder, entitled "Maintenance by the Electric Arc," is No. 7 of a series of folders on arc welding data. Any of these may be had upon request.

Manganese Steel.—Uses of "Amsco" manganese steel with "Fahralloy" products are described in a folder issued by the American Manganese Steel Co. "Fahralloy" is the name given to a series of alloys, at present fifteen in number, each having nickel and chromium in its analysis. "Fahralloy" products are adapted to uses where resistance to heat and corrosion is important. The American Manganese Steel Co. offers the cooperation of a department, directed by Dr. F. A. Fahrenwald, internationally known metallurgist, for the development of new and special metals to cope with unusual conditions. They will be glad to send you this bulletin upon application to any district sales office.

Water Wheels.—Bulletin W203 of the James Leffel & Co. is the first of a series being prepared on typical Leffel water wheel installations. This bulletin features the open penstock installation with submerged type gate operating mechanism. Inasmuch as the details in most water wheel installations are entirely covered by concrete or water, or both, the illustrations shown in this and succeeding bulletins will be of particular interest to users of water wheels. Write to the James Leffel Co., Springfield, Ohio, for a copy.

Power Graders.—A new folder from the W. A. Riddell Co., Bucyrus, Ohio, describes the Warco model "E" and "ER" power graders. Detail photographs and specifications are presented. The manufacturers will be pleased to send you a copy.

The longest highway bridge in the world



The San Francisco Toll Bridge is 7.1 miles long. The roadway is 27 feet between curbs. There were 346,016 lineal feet of piles, the largest 24 in. square, 105 feet long, and the shortest 16 in. square, 45 feet long. The entire construction cost $7,500,000.

This bridge was built by the Raymond Concrete Pile Co., New York. Consulting Engineers—Waddell & Hardesty, N. Y. Celite-for-Concrete was selected to insure workable uniform concrete which will resist the attack of sea water.

Completed 106 days ahead of schedule

625 tons of Celite were used to expedite the work on the San Mateo bridge connecting Oakland and San Francisco.

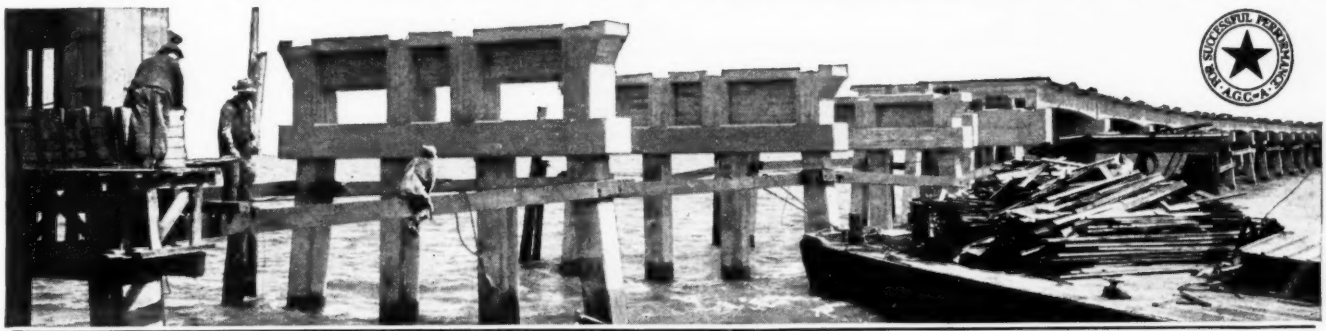
Because the bridge is located in salt water and was entirely precast twenty miles from the site, the greatest care was taken by the builders, Raymond Concrete Pile Co., to insure uniform, impervious, easy working concrete of high strength. Exhaustive studies were made, which resulted in the inclusion of Celite in all the concrete. Two pounds of Celite per bag of cement were used in the 4000 pound pile concrete; three pounds of Celite per bag of cement in the 2500 pound cap, beam and slab concrete, and five pounds of Celite per bag of cement in the railing and curbs.

The resulting concrete, all made at 4 to 5 in. slump, was transported in well filled buggies, without slopping, worked easily and thoroughly around the reinforcement, and came out of the forms with a smooth, impervious surface. By "fattening" the mix, Celite-for-Concrete improves workability more than would be obtained by increasing the Portland Cement content 25%.

The use of Celite produces concrete free from honeycombing with the surface so smooth and clean that decorative effects can be placed right over it without any other treatment. Celite obviates the temptation to use excess mixing water.

Hundreds of well known contractors and builders now use Celite in every yard of concrete they pour. Municipal, County, State and Government engineers in practically all sections of the country have approved or required its use.

With the aid of CELITE-for-Concrete



Johns-Manville
CELITE-FOR-CONCRETE
Better Concrete at Less Cost

JOHNS-MANVILLE CORPORATION
New York Chicago Cleveland San Francisco Toronto
(Branches in all large cities)

Please send me full information about Celite-for-Concrete.

Name.....

Address.....

CC-111-6

.....

Meter Boxes, Valve Housings, Etc.—A new ten page folder has just been received from H. W. Clark Company, Mattoon, Ill., illustrating and describing their gray iron products. The meter boxes are equipped with Wonder Lock, the key serving as handle of box, which cannot be removed without locking box. Products shown are: Meter boxes, box covers, wonder lock, valve boxes, valve housings, extension rings, repair lids, service box wrenches, etc. Illustrations clearly bring out the advantages of these products.

Airports.—"Getting on the Air Map with Caterpillar" is the title of a very attractive booklet issued by the Caterpillar Tractor Company, San Leandro, Cal. Booklet states: "There are more than 1,000 airports in the U. S.—some still in the making. The country needs 10,000." Booklet gives much interesting information concerning what is being done in various parts of the country to meet this need. Send for a copy, kindly mentioning our magazine.

Foundries.—Three folders, of special interest to foundry men, have just been issued by the Link-Belt Company, 910 S. Michigan Avenue, Chicago. These booklets describe the Continuous Malleable Foundry of the Saginaw Malleable Iron Division of General Motors Corporation; the three foundries of the American Manganese Steel Company, and the Link-Belt Vibrating Screen. The Link-Belt Company will be pleased to send copies upon request. If writing kindly mention our magazine.

Sluice Gates.—W. C. A. No. 32 issued by Rodney Hunt Machine Company, 101 Lake Street, Orange, Mass., gives some valuable information on sluice gates and hoisting equipment. This company, manufacturers of water controlling apparatus, will be pleased to give you detailed information about their hand operated, motor operated and hydraulic cylinder operated hoists and stands and accessories for all types of sluice gates, wide bronze facings, eliminating corrosion.

Concrete Pipe.—A very attractive book, giving much useful information on the sanitary engineering field as it applies to concrete pipe, is that issued by the Independent Concrete Pipe Company of Indianapolis, Ind. It is printed on heavy enamel paper, with many clear and comprehensive illustrations and is stitched into a heavy cardboard cover of pleasing appearance, putting the information into permanent form. In addition to a short history of the field, it gives the design, specifications and manufacturing methods of Independent Reinforced Concrete Pipe. The illustrations show manufacture and installations in places described.

Reinforced Concrete Pipe.—A pamphlet issued by the Lock Joint Pipe Company of Ampere, N. J., gives complete description and illustrations of reinforced concrete pressure pipe, which is of three kinds, poured pipe, cylinder pipe and centrifugal pipe and with expansion joints of two types, "Lead and Iron Joint" and "Lead and Steel Joint." All forms are steel held by cast-iron rings, insuring great accuracy and especial smoothness. In addition to photographic illustrations booklet contains several blue print drawings. Copies may be secured from eastern office, or from Chicago branch at 110 S. Dearborn Street.

Wrought Iron.—The A. M. Byers Company, Pittsburgh, Pa., has issued in handsome pamphlet form a reprint from World's Work "The New Story of Ancient Wrought Iron," by Donald Wilhelm. This is a story of the making of wrought iron from the earliest record down to the Aston Process put into practice last year by the A. M. Byers Company at their plant near Warren, O., and for which a new plant is being constructed at Ambridge, Pa. The manufacturer will no doubt be pleased to send copy of this reprint to anyone interested.

Street Department Supplies.—Catalog No. 31 issued by the Safety Gas Main Stopper Company, 523 Atlantic Avenue, Brooklyn, N. Y., bound in loose leaf type, illustrates and describes a long list of products including gas main bags, main plugs, stoppers, gauges, pipe cleaning brushes, cylindrical stoppers for water mains, etc. The new gauge and gas bag valve combination eliminates guess work in the use of inflatable bags and stoppers on which a pump is used. The pressure gauge shows when the pressure is sufficient and whether the bag is holding or losing air.

Mixer.—Koehring Company, Milwaukee, Wis., will be pleased to send you a special circular on the Koehring Weigh Mix, a standard heavy duty mixer with weighing batch hopper and water tank mounted on an auxiliary frame. All operations are controlled from platform, all aggregate is weighed in one hopper and water weighed on same beam.

Deep Well Power Plant.—The United Iron Works, Inc., Tulsa, Okla., will send upon request literature of interest on the "Pomona" double stroke deep well power pump. Booklet contains much interesting information on deep well pumping and pumping problems.

Water Meters.—For literature on water meter setting and testing equipment write to the Ford Meter Box Company, Wabash, Ind. Meters can be set or removed in an instant. The Ford standard testers can be adapted for testing meters in a series, each meter clamped in separately and the work economically and conveniently.

Sewer Cleaning Machine and Rods.—W. H. Stewart, P. O. Box 581, Jacksonville, Fla., and branches in St. Louis and Boston, as well as factory in Walkerville, Ontario, will be pleased to send literature describing his sewer cleaning machine and conduit rods. Folder describes the hand power machine or the Wonder Bucket equipment. Sewer rods are also illustrated and described, and a list of hand tools for use with sewer rods. This sewer cleaning device will remove anything possible to get into a sewer and clean thoroughly with the least possible difficulty.

Zeolite.—The Zeolite Chemical Company, 140 Cedar Street, New York City, will be pleased to send you "Softening Municipal Water Supplies by the Use of Zeolite," a booklet which describes green sand, a natural base exchange Zeolite mineral, used for water softening. Much interesting information is given.

Stillson Wrenches.—Sando Original and Moroco Popular Stillson wrenches, formerly made by the Moore Drop Forging Co. of Springfield, Mass., are now manufactured by the Trimont Manufacturing Company, 55 Amory Street, Roxbury, Boston, Mass. The Sando has a drop forged handle and jaw, and is scientifically hardened for maximum strength. Handle is made in wood or steel type. Both Sando and Moroco are described and sizes and prices given in booklet which will be sent by manufacturer upon request.

Fire Hydrants and Valves.—The Mathews Fire Hydrants built for easy installation and so that an extension section may be used to adapt them to new grades, are described in literature of the R. D. Wood & Co., Philadelphia, Pa. A broken Mathews can be replaced is a very few minutes and without excavation or breaking up the pavement. Manufacturer will be pleased to send you full information.

Chlorination. — Wallace & Tiernan Co., Inc., Newark, N. J., have had reprints made of a paper by Harry F. Ferguson (chief sanitary engineer, division of sanitary engineering, department of public health, Springfield, Ill.), and Clarence W. Klassen (assistant sanitary engineer, division of sanitary engineering, department of public health, Springfield), and appearing in the January issue of the Journal of the American Water Works Association. The title of the paper is "Are Your Wells and Reservoirs Contaminated?" The report treats of sources and reasons for water contamination, and states: "If owners of public water supplies overlook * * * or permit * * * contamination to continue * * * such owners * * * would be liable for damages for any illness * * * in accordance with recent court decisions." Wallace & Tiernan Co., Inc., will be pleased to send you a copy of this reprint, together with their technical bulletins describing their Chlorinators. Chlorination in the instances cited in the report would have protected the public health. Write for this literature.

Traffic Signals.—Catalog No. 129 has been issued by the Interflash Signal Corporation, 120 Broadway, New York City, describing Interflash "U. S. Standard" road signs and beacon signals for

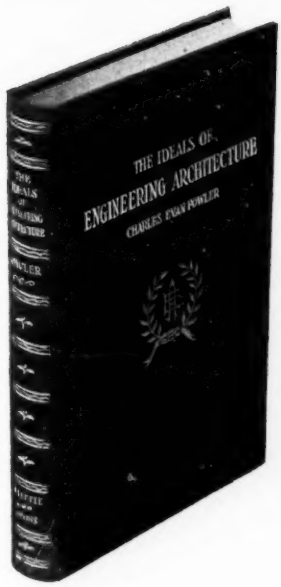
ENGINEERING
Set to the Music of
ARCHITECTURE

For the engineer whose soul is not deaf to the harmonies, the spacious rhythms, and the eloquence of architecture,—For the architect who is sensitive to the new demands of modern engineering structures, Charles Evan Fowler has struck an inspiring note in this new book. Progressive men in both professions must keep pace with the trends of development. Their progress, reputation, prestige depend on such alertness.

In "The Ideals of Engineering Architecture" the author gives a new vision of artistic design in Bridges, Buildings, Dams, Lighthouses, Sea Walls, Tunnel Portals, Retaining Walls, Piers, and kindred Engineering Structures. Fundamental design more than applied ornamentation is the requirement and will, in this phase of our civilization, become increasingly necessary.

Read this book and catch its spirit. We think it will color your future work. By our offer you may judge for yourself without cost.

—to the Increasing Profit of Both Professions



This Vital Volume Yours to Read

Bound in dark red leatherette with gold titles. 325 pages with 310 striking illustrations of ancient and modern engineering works. Just off the press. Only $4 net, with privilege of returning in 10 days. Read the coupon.

The author of this new book is highly qualified to speak with authority. Charles Evan Fowler, Consulting Civil Engineer, is a member of the American Society of Civil Engineers, Engineering Institute of Canada, Society of Terminal Engineers, a special lecturer for the University of Washington and author of many other papers and texts.

The Gillette Publishing Co., 221 E. 20th Street., Chicago, Ill.
Technical Publishers

Gillette Publ. Co., 221 E. 20th St., Chicago

Please send a copy of "The Ideals of Engineering Architecture," by Fowler. I agree to remit $4 plus postage by check or money order or return the book within 10 days.

Name.....

Address.....

City.....State.....

WW-6-29

The Ideals of Engineering Architecture

day and night service. Catalog describes the various types illustrated for use on highway and at street intersections where only a warning or cautionary signal is required. These are operated by either self-contained acetylene gas flushing equipment or direct from electric power lines. If interested in all-electric type of control signals ask for Catalog No. 229. For navigation lights for lighthouses, towers, buoys, wharves, bridges, etc., write for Catalog No. 329.

Chemicals.—The Kalbfleisch Corporation, 200 5th Avenue, New York, will be pleased to send you booklet on this subject in its connection with industries. The booklet is very handsome appearing, containing 84 pages, the first part being devoted to the sources, manufacture and uses of chemicals, together with a long list manufactured by the company—industrial and miscellaneous chemicals. The tables at the back of the book give atomic weights, corrections for temperatures and many other tables to serve the chemical user.

Hot Process Water Softener.—A new 12 page catalog in loose leaf style, Bulletin No. 5049, has just been issued by the Graver Corporation, East Chicago, Ind., describing their hot process water softener. Catalog gives views of installations and the component part of the softener. Booklet also contains tables showing savings made by use of softener. An extension to the front cover printed in colors enables the reader to refer to it as he reads the text of the booklet. An informative and attractive bulletin.

Paint Spray Brush.—Simons Paint Spray Brush Co. of Dayton, O., have issued a little booklet describing their paint spray brush and electric and gasoline air compressors to use with it. Containers, fittings, etc., are described and illustrations show the brush at work. For difficult painting jobs, such as large steel water towers, highway bridges, etc., this equipment saves in labor and paint. Ask for a copy of booklet G.

Tractors.—Catalog B-100 issued by Foote Bros. Gear & Machine Co., 215 N. Curtis Street, Chicago, covers all three models of the Bates "Steel Mule" tractor, 30-40-80. The Bates "Steel Mule" is easy to handle, has few wearing parts, and powered by Waukesha motor, it operates at high efficiency at all operating speeds. The crawlers run full length of tractor so it cannot nose into a bank with its radiator. Equipped throughout with IXL-ITE tool hard gears. Booklet fully illustrates, describes and gives specifications of all models.

Fire Hydrants, Gate Valves, Boxes, Indicator Posts, Etc.—A very attractive folder has been issued by the Iowa Valve Company, 701 Hubbell Building, Des Moines, Ia., giving the latest improvements on the products of this company, whose factory is located at Oskaloosa, Ia. Particular attention is called to the many improvements in the fire hydrant, such as the positive mechanical drip valve, bronze working parts, rubber mounted valve, new and improved adjusting feature which insures main valve in line with seat, all working parts removable through top of standpipe without use of special wrench or tripod, unrestricted water flow, delivering full pressure and simple construction. Folder gives description and illustration of fire hydrant and many of the other products of the company.

Chlorination. — Wallace & Tiernan Co., Inc., Newark, N. J., manufacturers of chlorine control apparatus, will be pleased to send you full information concerning their MSP Chlorinator. This equipment in duplicate is protecting hundreds of small cities by safeguarding their water supply. Records of cities where this method is in use will be furnished as well as much interesting information concerning sterilization of water.

Centrifugal Pumps.—Booklet W-67 issued by DeLaval Steam Turbine Co., Trenton, N. J., contains much interesting information concerning their geared steam turbine driven pumps, electric motor driven pumps or internal combustion engine driven pumps. Pumps for general water service, power plant service, sewage, drainage and irrigation, elevator and hydraulic pressure, marine or fire service, oil, pulp, acid, etc. Write for literature.

Planning a Waterworks System.—This is the title of a little booklet which the Cast Iron Research Association, Peoples Gas Building, Chicago, will be pleased to send you upon request. No community of 500 persons can afford to continue without a waterworks system, and many smaller towns have excellent systems. Booklet discusses Engaging the Engineer; Plans; Source of Supply; Estimating Requirements; Pumping System; Duplicate Equipment; Storage Supply; Distribution; Pipe; Hydrants; Records; etc.

Sewage Treatment Plants.—Bulletin No. 101, dated February, 1929, has just been received from the Pacific Flush Tank Company, 4241 Ravenswood Avenue, Chicago, or 9 Park Place, New York, describing the Sprinkling Filter Design using the Twin Dosing Tank Equipment. It is a very comprehensive presentation of this type of sewage treatment, and contains many detailed illustrations and data concerning large plants in use throughout the country. There are several pages of design data for single and twin tanks with percentage tables. There are also cuts and descriptions of dosing tank counter, nozzles and Marley Tees.

Chlorinizer.—Bulletin No. 20 put out by the Paradon Manufacturing Co., Arlington, N. J., gives full description of Paradon Chlorinizer. Chlorinization is in universal use for sterilization of water supplies, sanitation of swimming pools and for the disinfection of sewage. Operation, advantages, capacity, types of chlorinizers, applicability and specifications are all given in bulletin, and a list of a few typical installations is also included, regarding the Paradon equipment, a chlorinating device for small water supplies, swimming pools, and sewage plants such as in use in small municipalities, factories, camps, estates, country clubs, hotels, etc.

Cast Iron Pipe.—Write to the Central Foundry Company, 420 Lexington Avenue, New York City, for information concerning the cast iron pipe with machined hub and spigot ends, all cast iron, eliminating calking or use of any jointing material. No tool needed but a wrench.

Manhole and Catchbasin Covers.—Wm. E. Dee & Company, 30 North La Salle Street, Chicago, will be pleased to send prices and full particulars concerning their D & D Safety Cover. They guarantee this cover not to rattle or dish.

Diesel Engines.—A bulletin from the Busch-Sulzer Bros. Diesel Engine Company of St. Louis, Mo., has been issued describing the diesel power plant at Freeport, L. I., N. Y., where the 6th Busch-Sulzer Diesel—a 1,500 B. hp.—1,050 kw. unit, has just been purchased, making this the largest municipal Diesel plant in the United States, according to statement contained in folder. Their Diesel engines are built in 2-cycle and 4-cycle types, stationary and marine.

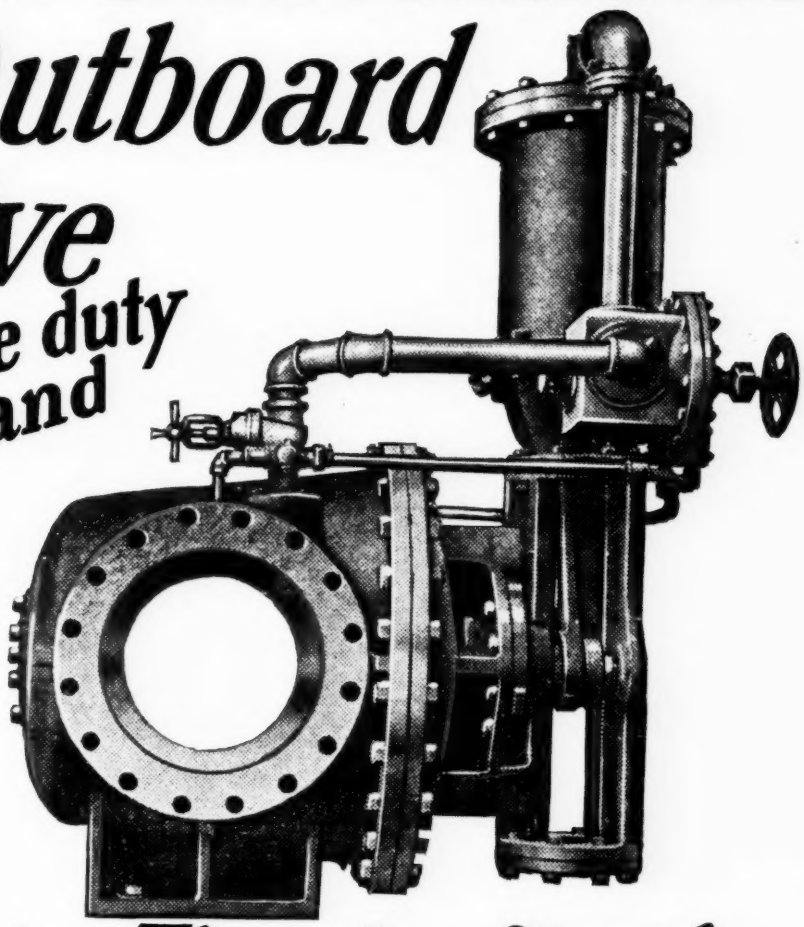
Steel Storage Tanks.—Municipal Catalog No. 2 issued by the Pittsburgh-Des Moines Steel Company, 4 Neville Island, Pittsburgh, Pa., give description and information regarding the product of this company for taking care of water consumption during the peak hours and insures a constant pressure at all times. Use of these tanks eliminate fire hazards when repairs are being made at the pumping plant. Information will be furnished concerning complete water works system, pipe lines, reservoirs, filtration, purification, etc.

Fact Book of Steel Construction.—The American Institute of Steel Construction, Inc., 285 Madison Avenue, New York City, has just published a Fact Book which lists the steel fabricators of the United States, Canada, Mexico and Hawaii. It presents in chart and tables the statistics of steel, fabrication and construction work. In addition to presenting data relating to the tallest and largest buildings in the United States it also publishes for the first time the most complete list of steel bridges in the U. S. This book has been brought out because of the now general use of the skyscraper throughout the land and the widespread interest in the fabrication of structural steel.

Porous Concrete Well.—F. Thorpe, 1932 Illinois Avenue, East St. Louis, Ill., will be pleased to send you folder

The New Automatic Cone Outboard Type Valve

Does the double duty of both a Stop and Check Valve



In Operation They Are Simple

The new Automatic Cone Outboard Type Valve has been a sensation ever since it was introduced a few months ago. Its enthusiastic endorsement by operating engineers has been far beyond our fondest hopes.

Automatic Cone Valves are designed that they do the double duty of both a stop and check valve.

When Automatic Cone Valves are in full open position, the waterway is similar to a piece of pipe and reduces frictional resistance to a minimum. The question of friction plays a very important part in the design and layout of plants and pipe lines; wherever obstructions are eliminated the increase in pressure can be evaluated on a dollar and cents basis which reflects itself into increased efficiency.

All the operating mechanism is "outboard" and can be inspected without interfering with operating. In fact, every part of the hydraulic mechanism can be removed and replaced without shutting down the pipe line.

The accompanying picture shows the automatic cone valve which is composed of two distinct mechanisms. The hydraulically operated cone valve and the control mechanism which properly times the opening and closing of the valve eliminate shock and water hammer. Cone valves are made for electrical, manual or hydraulic operation. All automatic cone valves are hydraulically operated. Manually operated and electrically operated cone valves are very adaptable for use as stop valves controlling distribution systems where pipe diameters are of large size. Write for further details.

AUTOMATIC CONE VALVE CO.
Builders Building, Chicago, Ill.

AUTOMATIC CONE VALVES

describing this type of well and will furnish a list of references. Some of the outstanding features are length of life, elimination of repair or maintenance costs, satisfied owners, etc.

Toledo Torch.—The new Toledo Torch "Champion" is the product of the Toledo Pressed Steel Co., Toledo, O. Write to the manufacturer for full information as to construction, service and costs.

Steel Sheet Piling.—Address Wemlinger, Inc., Singer Building, New York, or 228 North La Salle Street, Chicago, for information in regard to buying or renting steel sheet piling.

Clay Products.—Wm. E. Dee Clay Mfg. Co., 30 N. La Salle Street, Chicago, manufacturers of standard and double strength sewer pipe, drain tile, culvert pipe, well tubing, flue lining, wall coping and fire brick, will be pleased to send you full information on any or all of these products.

Sewer Flusher.—Petersen's Hydraulic Flusher Company, 277 First Avenue, Milwaukee, Wis., will be pleased to send you literature illustrating and fully describing their sewer and pipe flushers. It is made in three styles of heavy grade canvas and waterproof tubing. A labor saving tool for city, contractors and manufacturers, and an economical way of clearing sewers.

Cast Iron Pipe.—An attractive folder from the McWane Cast Iron Pipe Company of Birmingham, Ala., and Provo, Utah, shows many successful uses for this pipe. It is used in parks for feeding sprinkling systems, by railroads in yards for water, air and low-pressure steam lines, etc., all of the 2-in. size. It is also made in 4, 6, 8, 10 and 12-in. sizes. Manufacturer will be pleased to send literature illustrating and describing pipe in all sizes for all uses.

Pumps.—Bulletin P-29 issued by the Jaeger Machine Company, Columbus, O., gives illustrations, specifications and full description of diaphragm, plunger type, lift and force centrifugals. The Speed Boy is a 4-cycle high speed engine with foot starter coupled with nonclogging big volume pump with Jaeger open type brass impeller that handles 25 per cent to 28 per cent solid matter such as sand, mud or solid stones. Write for this bulletin.

Cast Iron Pipe.—A very attractive booklet called "Small Diameter Cast Iron Pipe" has just been issued bearing the name of the American Cast Iron Pipe Co., Birmingham, Ala. Types of small diameter pipe described in booklet include: Simplex Prepared Joint Cast Iron Pipe; Two-Inch Bell-and-Spigot Cast Iron Pipe; Two-Inch Prepared Joint Cast Iron Pipe; Threaded-End Cast Iron Pipe; Doublex Simplex Cast Iron Pipe; Flanged Cast Iron Pipe; Cast Iron Pipe for Vitaulic Joints; Bronze Welded Joints and Small Diameter Cement Lined Pipe. Booklet is printed on heavy enamel paper and has an extra heavy cover.

Calatom.—An admixture for concrete which is mined, milled and refined exclusively by Monterey Products Company, Monterey, Cal., and distributed east of the Rocky Mountains by Tamms Silica Company. Calatom is a low water absorption diatomaceous earth for workability and waterproof concrete. Write to the Tamms Silica Company, Stock Exchange Building, Chicago, Ill., for literature giving complete information concerning this powered admixture.

Deep Well Water Systems, Etc.—Alamo Engine Company, Hillsdale, Mich., has issued a very attractive 60 page booklet in loose leaf style, describing the use of Alamo-Dorward Rotary Power Head, for operating deep well and other types of reciprocating plunger pumps. Booklet contains cross sectional drawings, explanation of capacity table captions with several pages of capacity tables.

Meter Boxes, Couplings, Testers, Service Boxes, Etc.—Catalog No. 24 issued by H. W. Clark Company, Mattoon, Ill., gives full information in regard to their meter protection boxes, constructed of bronze, with locking device and assuring safeguard from climatic conditions. Construction provides for accessibility for repair work or replacements. Full particulars furnished on all equipment.

Gunite.—Write to the Cement Gun Construction Company, 537 S. Dearborn St., Chicago, for full information concerning this product. They will be pleased to furnish particulars and make contractors' estimates if desired.

Centrifugal Pumps.—The Byron Jackson Pump Co., Berkeley, Cal., will be pleased to send you literature giving full information concerning centrifugal pumps for any purpose. They have branch offices in San Francisco, Chicago and New York, as well as Portland, Salt Lake, Dallas and Phoenix. Their deep well turbines make available the water from deep stream sources. Write for particulars.

Cast Iron Pipe.—"Spi-Cor" is the title of a little booklet issued by the American Casting Company, Birmingham, telling the story of a new era in "culverting." It gives much interesting information in condensed form on spiral corrugated cast iron pipe. If writing for booklet, kindly give the name of our publication.

Paved Invert Culverts.—"Paving the Culvert to Combat Erosion" is the title of a comprehensive pamphlet issued by the Armco Culvert Mfrs. Association, Middletown, O. This product is designed for use where culverts carry highly sedimentary streams, on steep grades, in mountainous country, storm sewers, etc. The booklet illustrates in detail the paved invert and describes tests applied in developing it. The culvert must be made to withstand hydraulic traffic within and vehicular traffic from above. The booklet describes the Armco system. Kindly give the name of our publication if writing manufacturer for literature.

Excavator.—Write to the Bucyrus-Erie Company, South Milwaukee, Wis., or Erie, Pa., for bulletin on their D-2 Diesel Drag-Shovel. This shovel is built for the hardest work at a minimum cost. Easily convertible to clamshell-crane, shovel or dragline. Manufacturer will be pleased to furnish you with performance records of this equipment.

Sludge Removal.—The Link-Belt sludge collector is recommended by the manufacturer for its sturdy mechanism and reliability in removing sludge from sedimentation tank. An excess of accumulation of sludge will not slow down or stop operation. For complete information concerning this or other sewage treatment plant equipment, write to the Link-Belt Co., 300 W. Pershing Road, Chicago. Kindly mention our magazine.

"The Cleaning of Water Mains."—This is the title of a booklet issued by the National Water Main Cleaning Company, 32 Church St., New York, describing the method so successfully used by them for the past twenty years. Write for a copy, giving the name of our magazine.

Well Systems.—Write to Layne & Bowler, Inc., Memphis, Tenn., or any of their representatives located in all the principal cities, for information about the Layne Water Well Systems. They will be pleased to give you the benefit of their long years of experience in this field.

Centrifugal Pumps.—For a complete catalog on this equipment write to the DeLaval Steam Turbine Co., Trenton, N. J., asking for Catalog B. This is a very handsome 72-page catalog, discussing single stage and multistage pumps, for general water service, power plant service, including boiler feeding, condenser circulating and hot-well service, water works service, including main pumping units and booster, filtration and flushing service. Pumps for sewage, drainage and irrigation, elevator and hydraulic pressure, marine or fire service, oil, pulp, acid, etc. The catalog is beautifully illustrated and gives cross sectional drawings showing details of pumps. There is a section on manufacturing methods and materials, and one on testing, also just what information should be furnished in seeking plant for individual requirements. Manufacturer will be pleased to send you a copy of this informative book. Kindly mention our magazine.

SAVE YOUR TIME! USE OUR SERVICE! Prices on equipment, names of manufacturers or their catalogs will be cheerfully furnished to you by our Service Department. Write Municipal News and Water Works, 221 E. 20th St., Chicago.